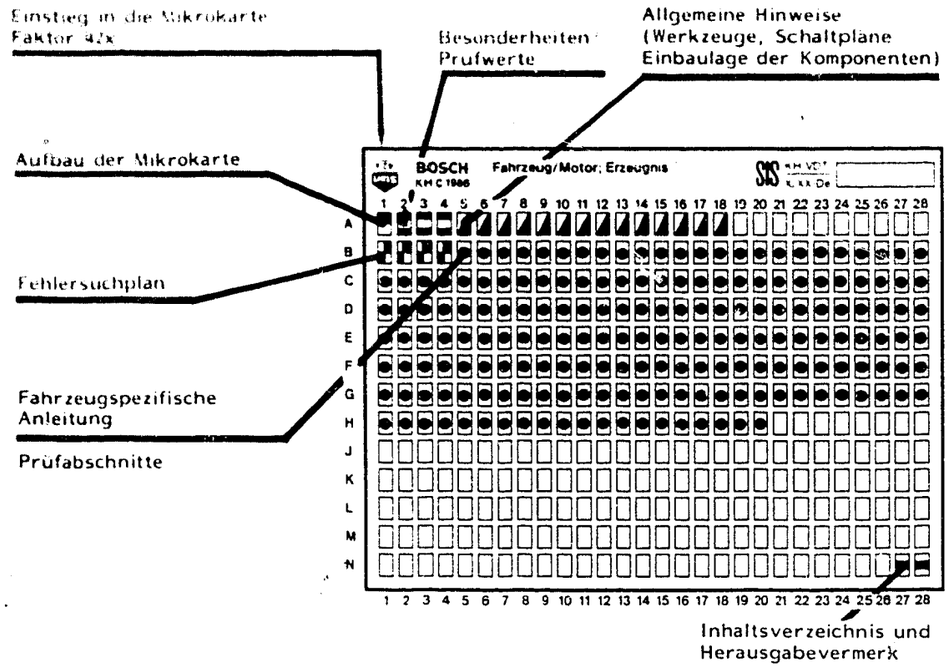


LAYOUT OF THIS MICROCARD

1. Read from left to right.

2. Title of microfiche (appears on each coordinate).

E16	Product/component/test step	

Coordinate

3. Limits of section

==>	<==>	<==	=> <=
Beginning	Mid-section	End	One-page Section

A01	—	=> <=

This microcard contains the trouble-shooting instructions for the distributor-type fuel injection (VE) pump in the following BMW models valid at the time of writing:

* BMW 524td (09.84 ->) 2.4 l - Turbo-Diesel
* BMW 324d (10.85 ->) 2.4 l - Diesel

1. SPECIAL FEATURES

* ADA (324d)

* Exhaust turbo-supercharger (524 td)

2. TEST SPECIFICATIONS

C07

2.1 Idle speed

Engine-oil temperature > 60°C:	750...800 min $^{-1}$
Engine cold:	900...1050 min $^{-1}$

C19

2.2 Nozzle-opening pressure

Opening pressure (new nozzles):	150 + 8 bar
Opening pressure (used nozzles):	135 bar
Pressure difference, max.	15 bar

C26

2.3 Filter test

Max. permissible differential pressure 0,3 bar

D17

2.4 Pressure drop

Max. permissible 25 %

A02	—	==>

H01

2.5 Injection pump - engine coordination:

Engine position =
TDC at 1rst cylinder (6th cyl. at overlap)

Setting value

324d:	0,74 − 0,02 mm after BDC
524td:	0,74 + 0,02 mm after BDC

Inspection value

324d:	0,70...0,74 mm after BDC
524td:	0,72...0,76 mm after BDC

D17

2.6 Compression:

approx. 24 bar
at least 20 bar

Requirements for testing:

* Coolant temperature max. 35° C
* Remove sheathed-element glow plugs
* Disconnect plug at preheating control unit (short-circuit hazard)

H08

2.7 Charge-air pressure

Nominal value under load above
above 2500 min $^{-1}$: 0,77...0,83 bar

H12

2.8 Charge-air pressure relief valve

Opening pressure: 0,90...1,10 bar

H18

2.9 ADA reference-pressure regulator: 690...720 mbar (absolute)

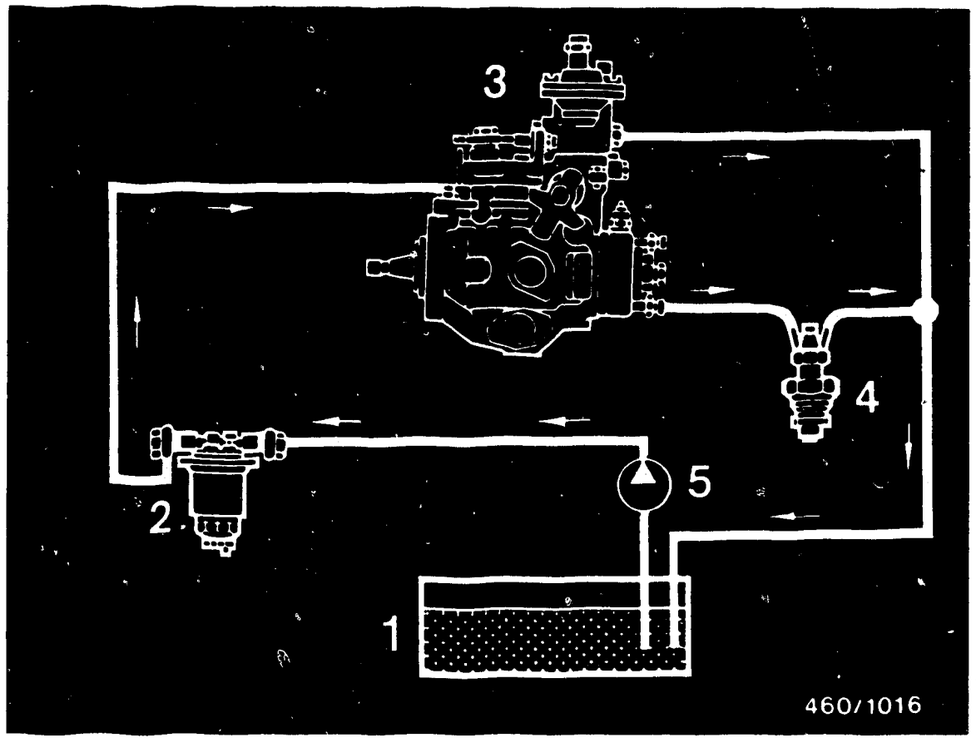
D03

2.10 KSB solenoid-operated valve:

3,5...5,5 Ω at 20°C

2.11 Tightening torques

Fuel-injection pump fastening screws:	20...24 Nm
Injection-pump gear:	45...50 Nm
Camshaft gear:	65...70 Nm
Tensioning-pulley bracket on engine (bolt and nut):	20...24 Nm
Fastening screws for nozzle-holder assemblies:	40...45 Nm
Fuel lines:	20...25 Nm
Sheathed-element glow plugs:	20...30 Nm
Toothed-belt pulley of jack shaft:	55...65 Nm
V-belt pulley / vibration damper	22...24 Nm
Tension for tensioning-roller holder (new toothed belt):	45...50 Nm
Toothed belt (service life above 15,000 km/9,000 miles):	30...35 Nm
Bleeder screw (thermostat housing):	6...10 Nm
Cylinder-head hood:	8...10 Nm
Turbo-supercharger at exhaust manifold:	23...27 Nm
Exhaust pipe at exhaust manifold:	43...48 Nm
5.5°C thermo-switch at cylinder head / fuel filter:	17...19 Nm

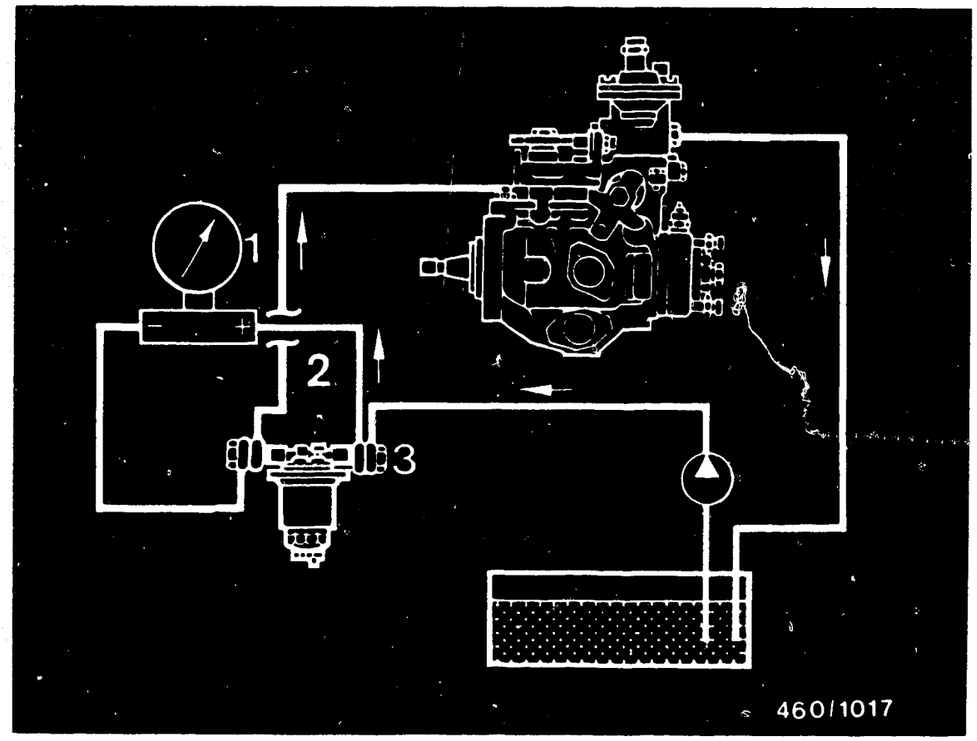


1 = Fuel tank
2 = Fuel filter
3 = Distributor-type fuel-injection pump
4 = Injection nozzles
5 = Pre-supply pump (on USA version)

3. FUEL-LINE DIAGRAM

Fuel lines are connected per the above diagram.

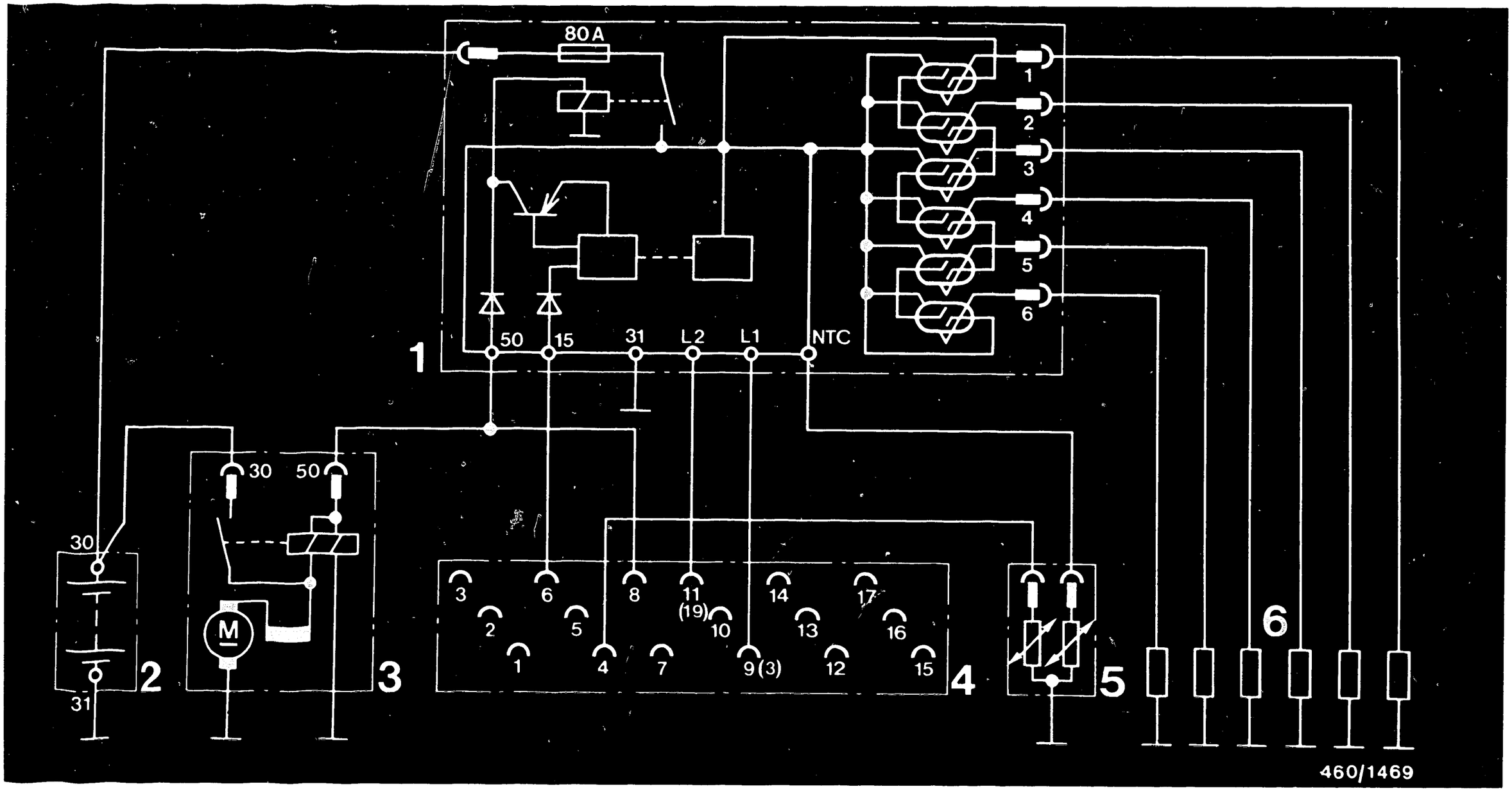
The direction of fuel flow is indicated by the arrows.



1 = Differential-pressure gauge
2 = Filter drain (use inlet union and extra-long reducer bushing 2 443 456 020)
3 = Filter inlet (use inlet union and extra-long reducer bushing 2 443 456 020)

3.1 Connection diagram for filter test

Connect differential-pressure gauge to fuel filter using appropriate connection pieces.

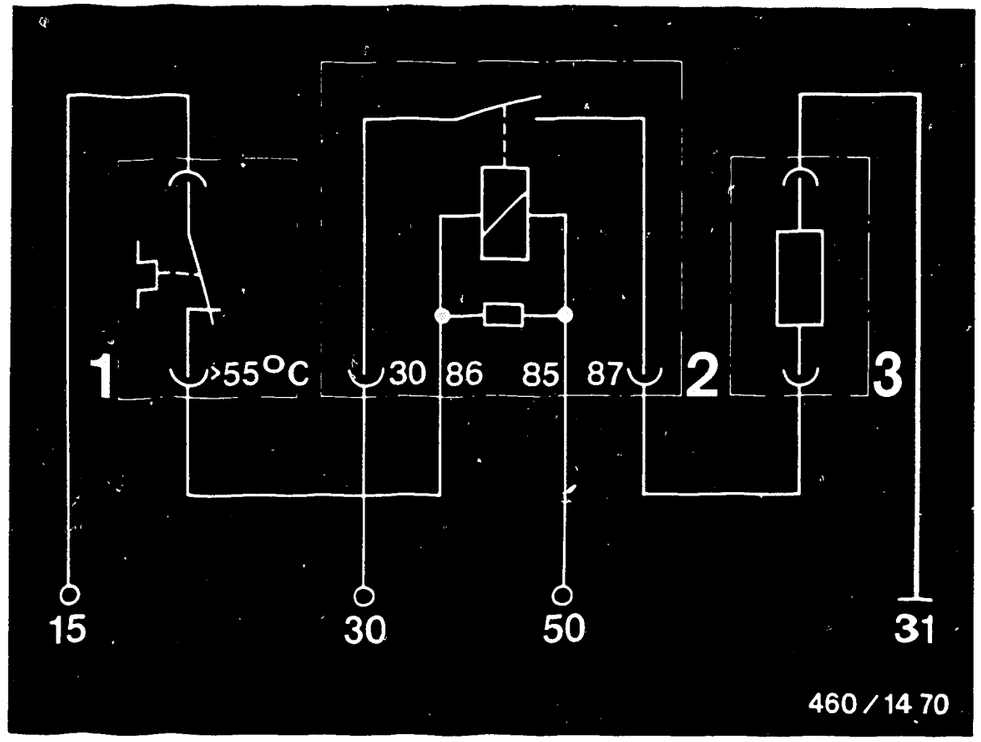


1 = Glow-duration unit
2 = Battery
3 = Starting motor
4 = Diagnostic plug
5 = Temperature sensor
6 = Sheathed-element glow plug

Note: () = 324d

4. PREHEATING SYSTEM TERMINAL DIAGRAM

A07 —⟹ A08 ⟸—



1 = 5.5°C thermo-switch
2 = Relay for fuel heating
3 = Heating element

5. FUEL PREHEATING TERMINAL DIAGRAM

6. TEST EQUIPMENT AND TOOLS

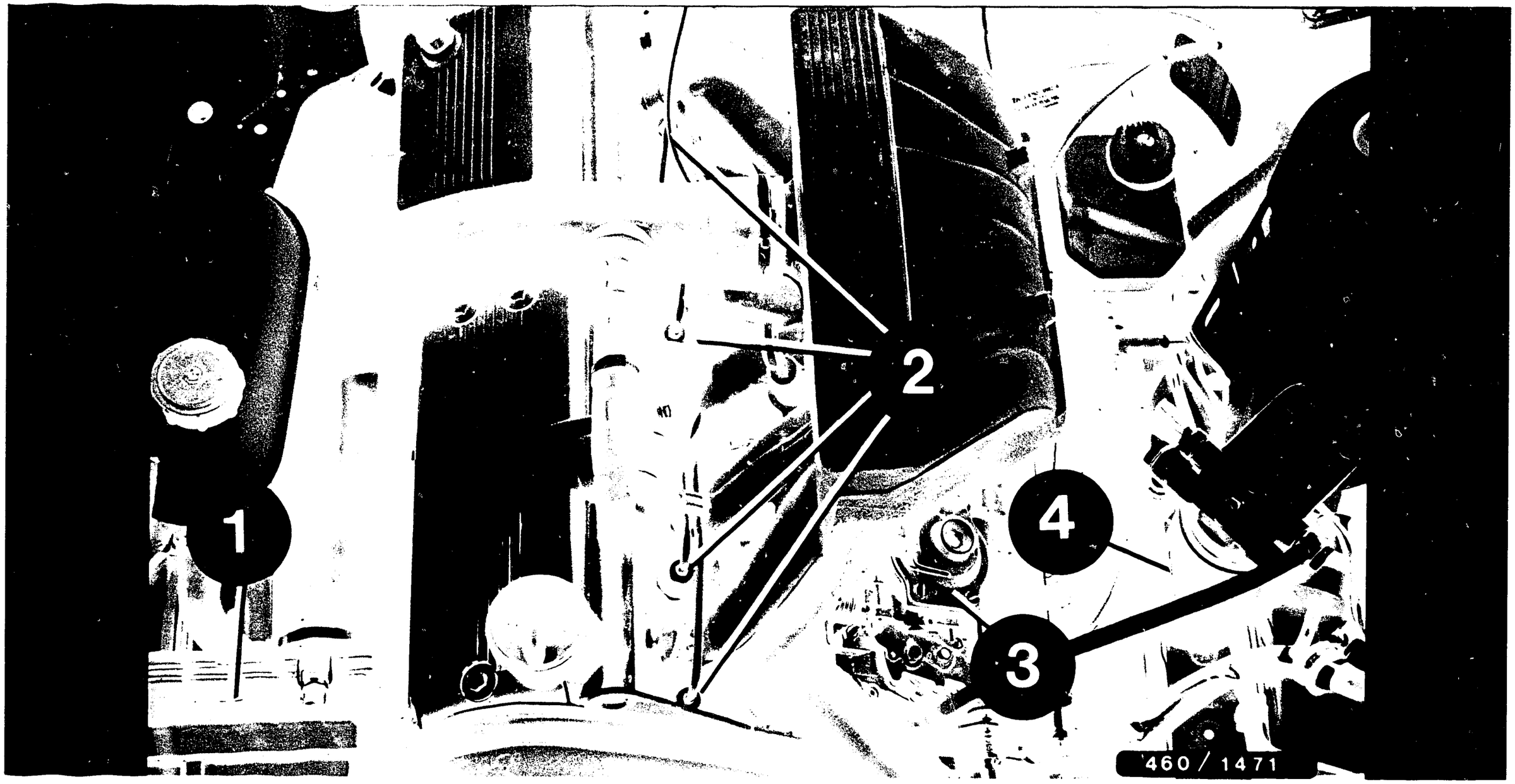
Description	Part number	Application
Holding and pressing device	KDEP 1156	Positioning injection-pump gear with toothed belt
Setting mandrel	KDEP 1138	Locking injection-pump gear in position
Setting mandrel	KDEP 1139	Locking flywheel in position
Toothed-belt tester	KDEP 1121	Testing toothed-belt tension
Stop device	KDEP 1136	Positioning camshaft
Box wrench	KDEP 1115	Loosening and tightening injection tubing
Measuring tool	KDEP 1085	Coordinating pump and engine
Small dial indicator 1/100 mm graduation	Commercially available e.g. Hahn & Kolb 7000 Stuttgart West Germany Part no. 33 003 with adapter KDEP 1127	Coordinating pump and engine

Test equipment and tools (continued)

Description	Part number	Application
Pressure-measuring device	KDJE-P 100	Testing charge-air pressure
VA tester	ETT 011.00 0 684 101 100	Testing pre-heating system
Nozzle tester	EFEP 60 H 0 681 200 502	Testing injection nozzles
Compression tester with connection nipple	Part no. 6 220 103 236 and angle piece, part no. 6 220 103 163 from: Moto Meter Co. Daimler-Straße 6 7250 Leonberg West Germany	Testing engine compression
Compression-loss tester	EFAW 210 A 0 681 001 901	Testing engine compression loss
Vacuum hand pump, Mityvac	K o r i n t h Co Ludwig-Kloos- Straße 21 6450 H a n a u (Steinheim) West Germany	Testing ADA (324d)

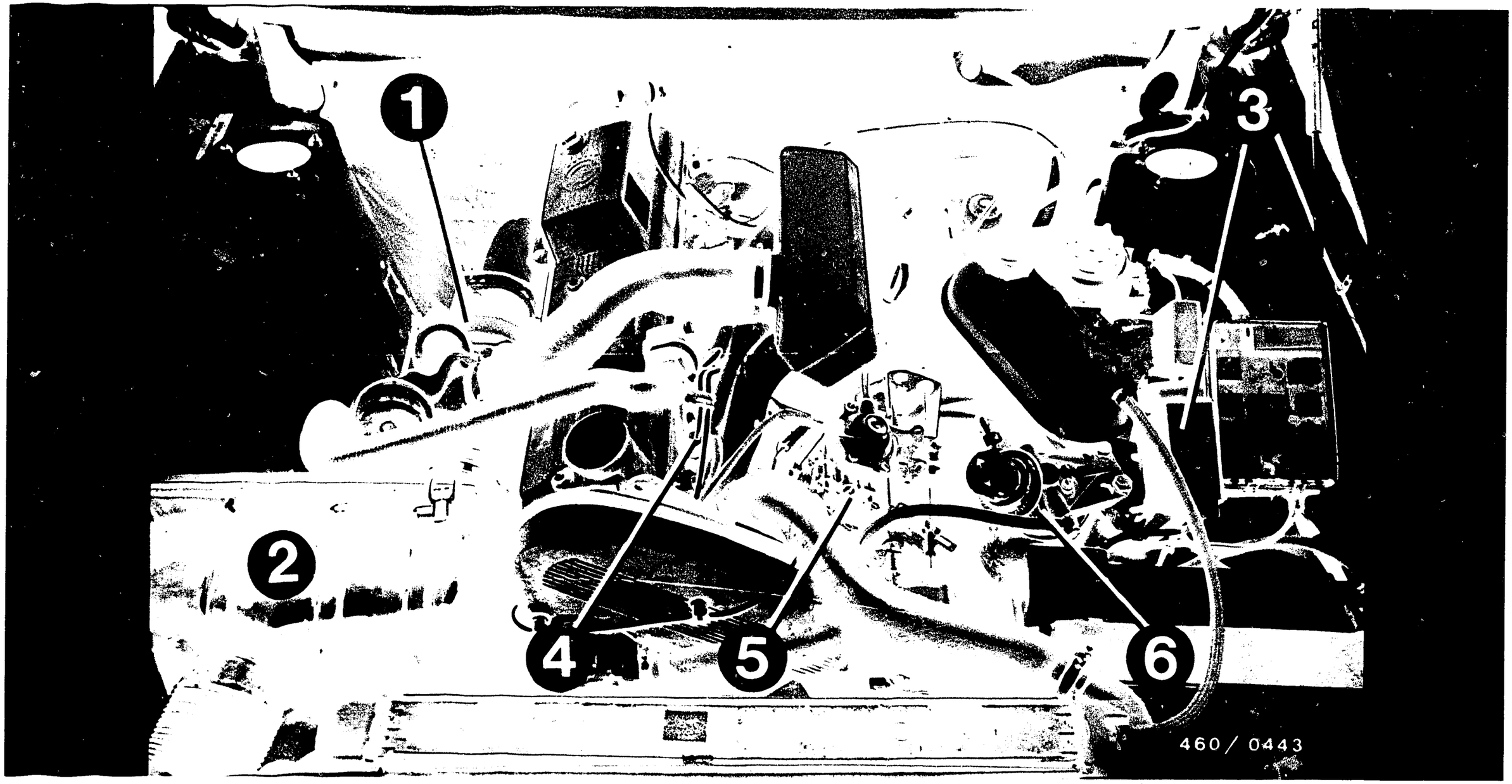
Test equipment and tools (continued)

Description	Part number	Application
Tachometer	Commercially available, e.g. Dr. E. Horn GmbH Meßgerätefabrik Postfach 40 7036 Schönaich West Germany Ordering des.: HT 446 (with digital display)	Setting engine speed
Differential-pressure gauge	Commercially available, part no. NG 160/311-911 - 1.0 + 4.0 bar from H a e n n i Co. Nauheimer Str. 78-50 7000 Stuttgart50 West Germany	Filter testing
Evaluation unit Accessories box with proportioning pump	0 684 102 050 0 681 169 038	Smoke testing
Press-in sleeve	KDEP 1562	Installing seal rings for nozzle-holder assemblies
Thrust member	KDEP 1043/0/5	Disassembling and assembling nozzle-and-holder assemblies



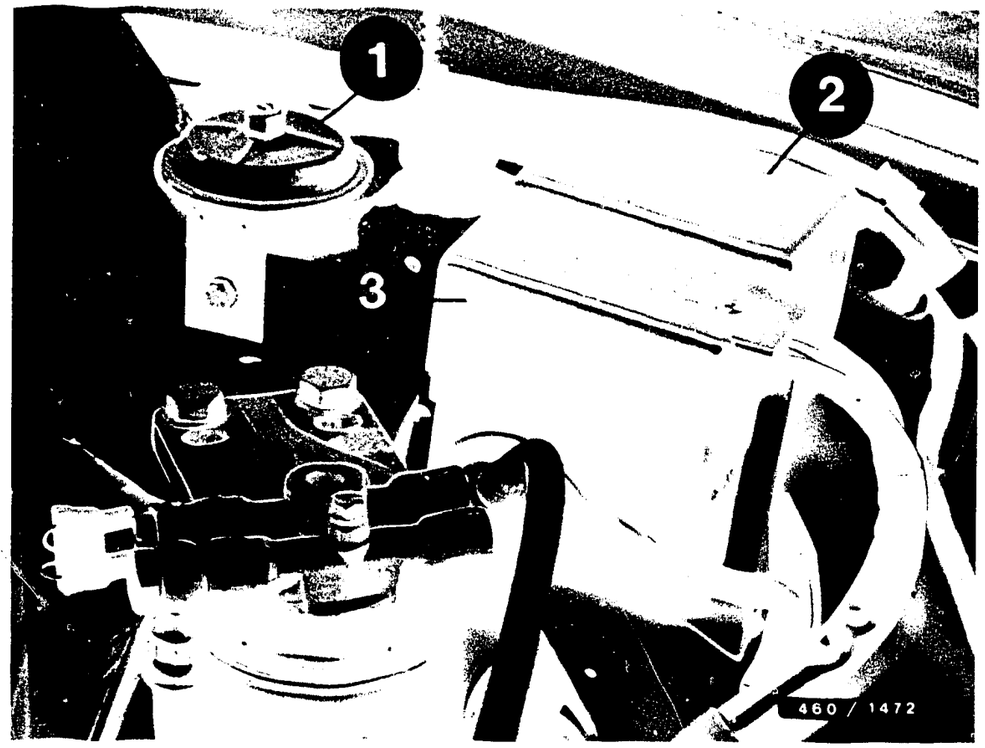
1 = Air filter
2 = Injection nozzles
3 = Fuel-injection pump
4 = Fuel filter

7. INSTALLATION POSITION OF COMPONENTS, BMW 324d



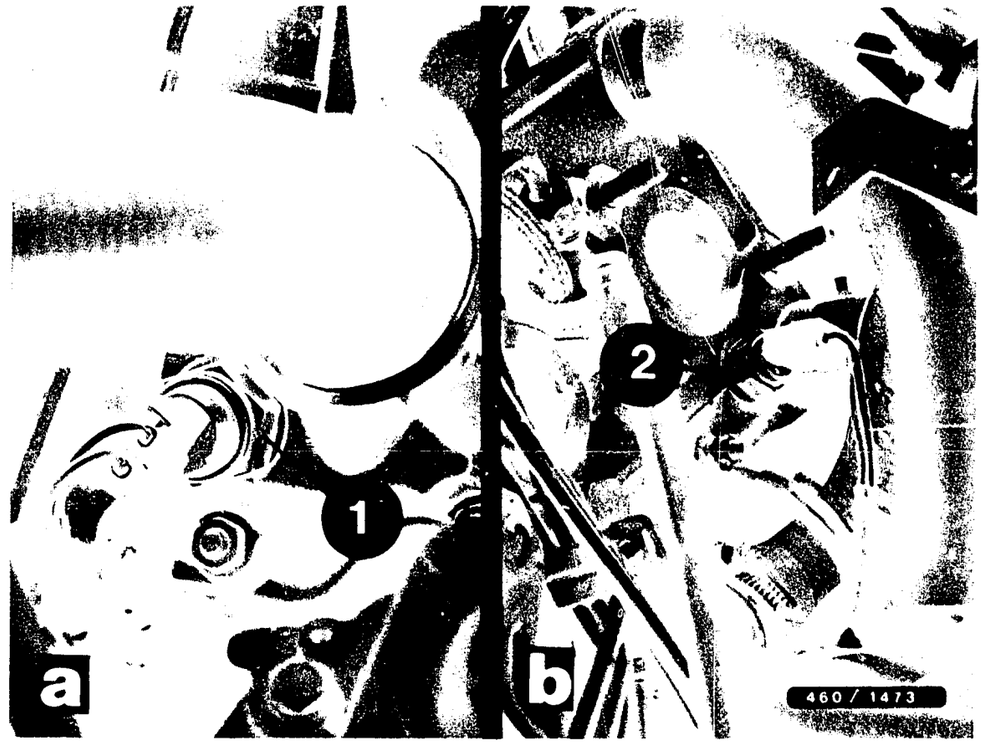
1 = Turbo-supercharger
2 = Air filter
3 = Preheating system
4 = Injection nozzles
5 = Fuel-injection pump
6 = Fuel filter

7.1 Installation position of components, BMW 524td



1 = Reference pressure regulator (ADA)
2 = Relay for fuel heating
(underneath hood)
3 = Glow-duration unit

7.2 Installation position of components, BMW 324d



1 = Temperature sensor (glow-duration unit)
2 = Temperature sensor (cold-start injection advance)

7.3 Installation position of components (BMW 324d/524td)

8. TROUBLE-SHOOTING

Customer complaints (symptoms of trouble)

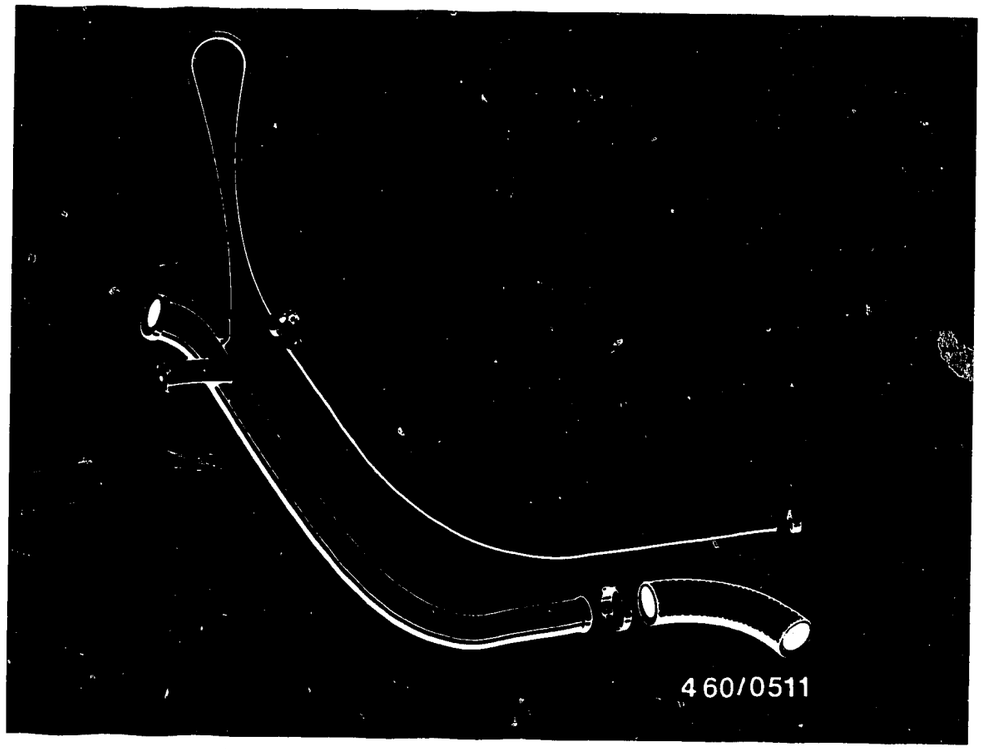
1. Engine fails to start or starts only with great difficulty when warm	2. Engine fails to start or starts only with great difficulty when cold	3. Engine surges when idling	4. Uneven idling when engine is warm	5. Engine misses during vehicle operation	6. Unsatisfactory performance	Cause (component defect)	Coordinates
*	*			*	*	Tank empty; tank ventilation clogged	B05
	*			*	*	Fuel preheating defective	D01
	*		*			Inj. sequence does not corres. to firing sequence (check routing of fuel-inj. tubing)	B06
				*		Overflow restriction clogged	B07
*	*					Shutoff device defective	B08
		*		*	*	Inlet-union screws of inlet and return lines clogged (see fuel-line diagram)	B12
*	*		*	*	*	Air in fuel system	B14
	*					Heavy paraffin deposits in filter during winter operation (replace filter box)	B20
*	*			*	*	Lines leak or are broken; loose connections	B23
*	*			*	*	Supply lines clogged (check fuel lines)	B26
*	*			*	*	Injection tubing clogged or restricted (check fuel lines)	B26
	*					Cold-start injection advance defective	D03
					*	Engine air filter clogged	B27
			*			Idle speed incorrect	C07
*	*		*		*	Injection nozzle defective	C18
	*	*	*		*	Injection pump and engine incorrectly coordinated	H01
*	*			*	*	Fuel filter clogged (differential-pressure test)	C26
	*					Preheating system defective	D04
					*	Timing device defective (remove fuel-injection pump)	D16
	*		*			Poor or uneven engine compression	D17
					*	Maximum engine speed incorrectly set (remove fuel-injection pump)	D28
*	*	*	*	*	*	Fuel-injection pump (governor) defective or out of adjustment (remove fuel-inj. pump)	D28
					*	Check turbocharger for sealing and charge pressure	H08

B01 — ⟹

B02 — ⟺

Customer complaints (symptoms of trouble)

7. Insufficient performance and excessive fuel consumption with/without smoke formation	8. Engine cannot be switched off	9. Engine runs rough, black smoke in full-load range; possibly lack of power	10. Fog-like smoke in full-load range (white)	11. Incorrect engine speeds	12. Engine will not rev up when cold	13. Distributor-type fuel-injection pump becomes too hot	Cause (component defect)	Coordinates
			*		*		Supply lines clogged (check fuel lines)	B26
			*		*		Injection tubing clogged or restricted (check fuel lines)	B26
		*	*				Engine air filter clogged	B27
				*			Incorrect idle speed	C07
		*					Injection nozzle defective	C18
*		*	*		*		Fuel-injection pump and engine incorrectly coordinated	H01
			*		*		Fuel filter clogged (differential-pressure test)	C26
		*	*				Timing device defective (remove fuel-injection pump)	D16
*					*		Poor or uneven engine compression	D17
				*			Maximum engine speed incorrectly adjusted (remove fuel-injection pump)	D28
*	*	*	*	*	*	*	Fuel-inj. pump (governor) defective or out of adj. (remove fuel-inj. pump)	D28
			*		*		Tank empty; tank vent clogged	B05
*							Engine control out of adjustment	F28
		*		*	*		Ign. seq. does not corres. to firing seq. (check routing of fuel-inj. tubing)	B06
						*	Overflow restriction clogged	B07
	*						Shutoff device defective	B08
		*	*	*			Inlet-union screws of inlet and return lines clogged (see fuel-line diagram)	B12
		*		*			Air in fuel system	B14
				*			Severe paraffin deposits in filter in winter operation (replace filter box)	B20
*							Lines leak or are broken; loose connections	B23

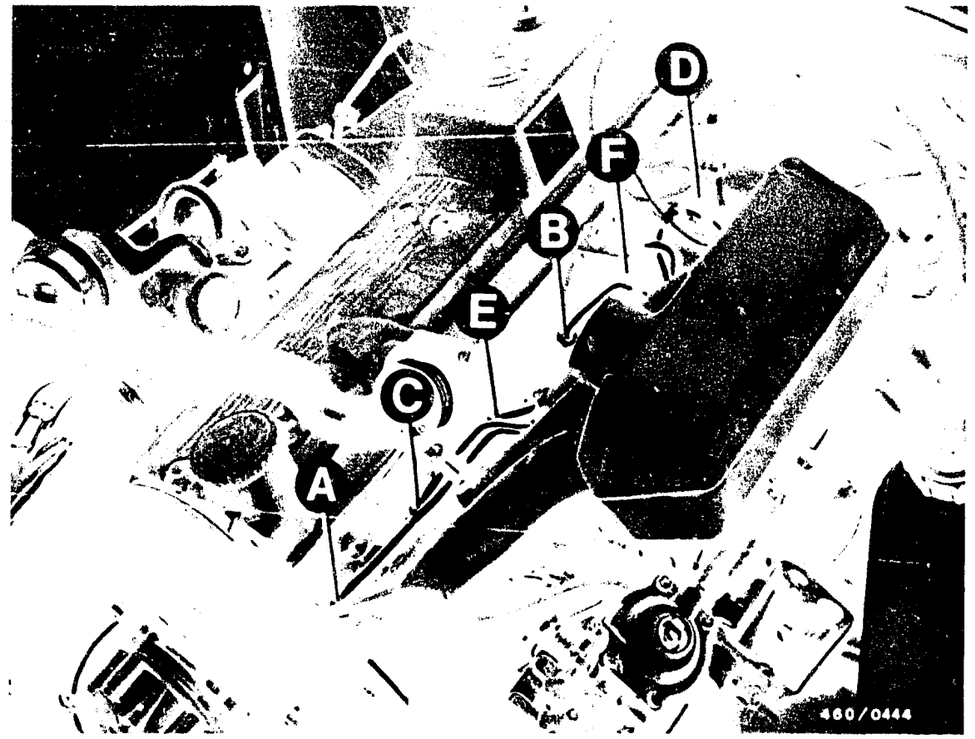


9. CHECKING TANK VENTILATION

Open tank cover.

If the fault no longer occurs after opening the tank cover, tank ventilation is defective.

Inspect tank ventilation for blockages.

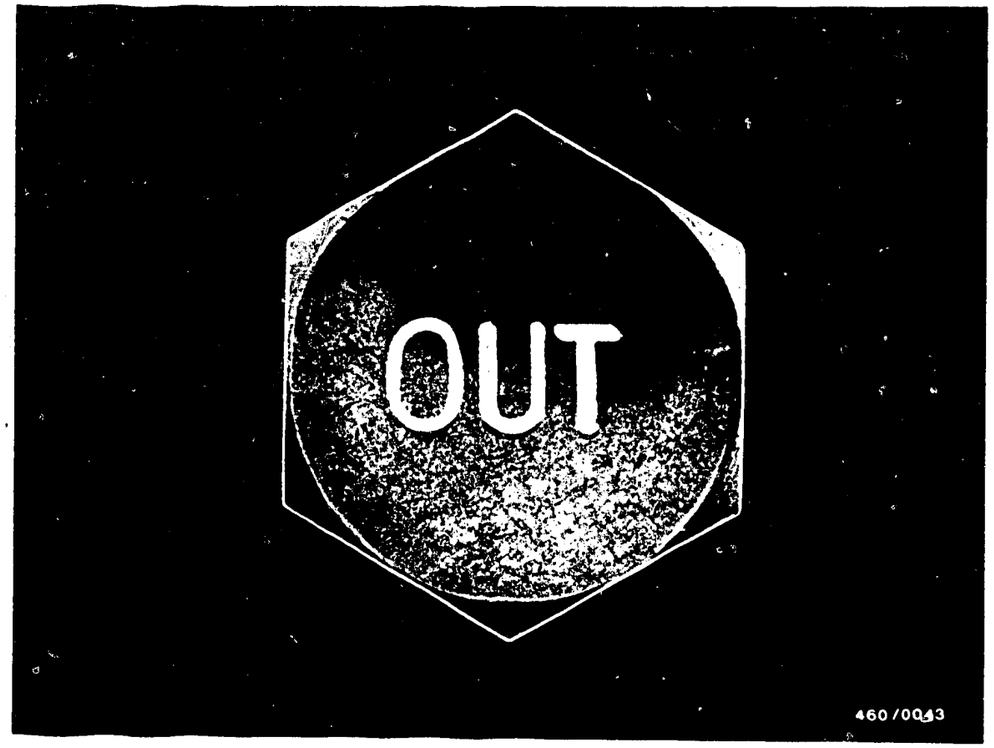


10. CHECKING ROUTING OF FUEL-INJECTION TUBING

The fuel-injection lines are held together by clamps so that it is impossible to get the outlets mixed up.

If, however, there is any doubt, check the routing of the lines as shown in the illustration above.

The pairing of the fuel-injection pump outlets with the individual engine cylinders is identified by the letters A...F.

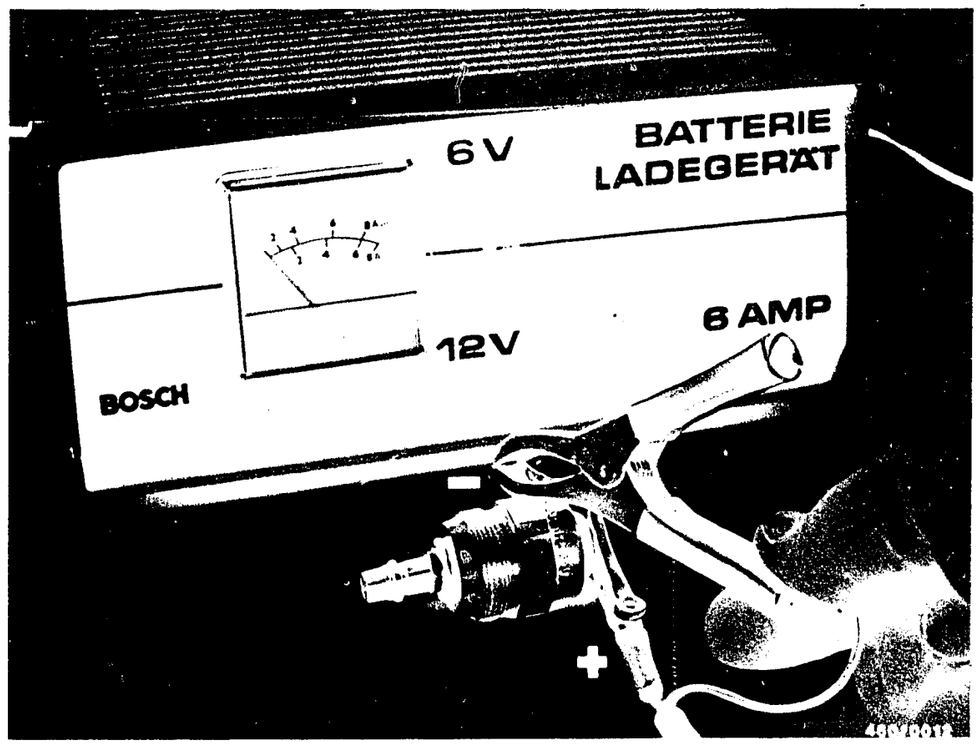


11. CHECKING OVERFLOW RESTRICTION

Unscrew the overflow restriction on the fuel-injection pump (marked "OUT").

Visually inspect the wire screen for impurities.

If there is any doubt, replace the overflow restriction.



12. TESTING OPERATION OF SHUTOFF DEVICE

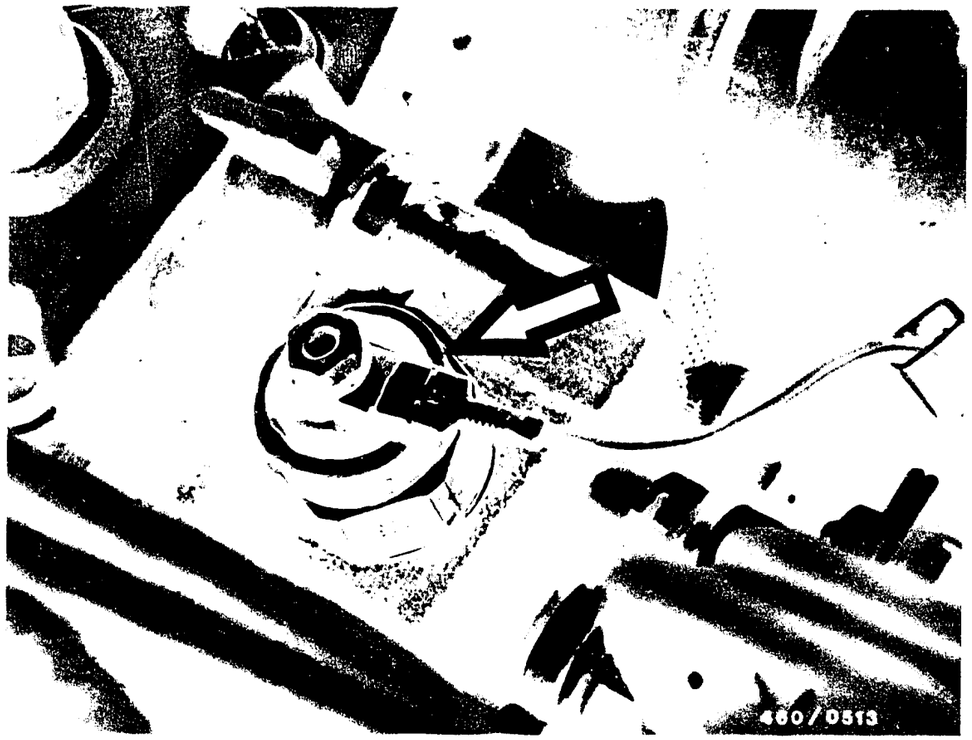
12.1 Engine fails to start

Check whether solenoid-operated valve is supplied with voltage (min. 10 V) when the glow-plug and starter switch (drive position) is switched on.

If voltage is present, remove fuel-injection lines and take out solenoid-operated valve.
Cleanliness is essential!

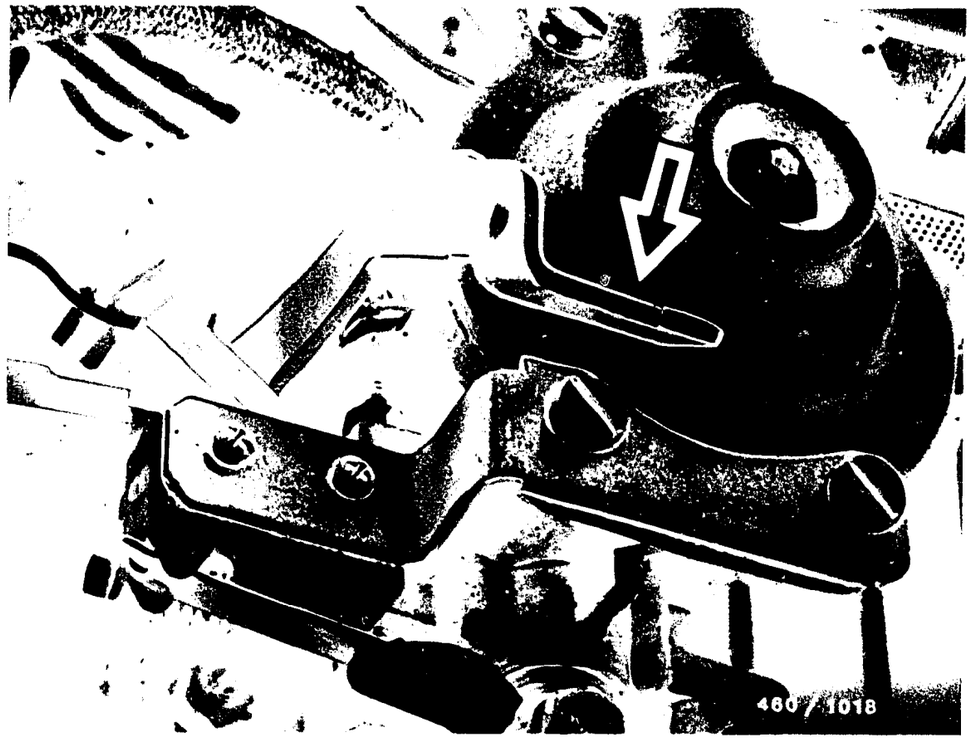
Check operation of solenoid-operated valve when removed.

Note:
Voltage may be applied to the solenoid-operated valve when it is removed only for a brief period, as it is no longer being cooled by the fuel.

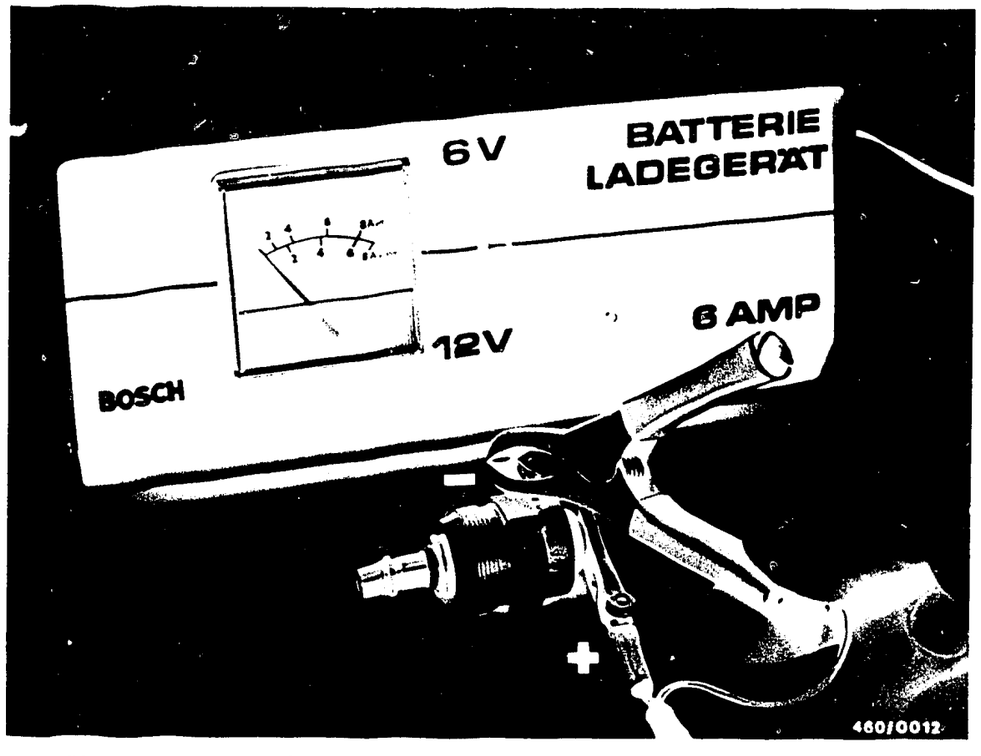


12.2 Engine cannot be switched off

When the glow-plug and starter switch is in the stop position, there must be no voltage across the solenoid-operated valve (arrow) i.e. the fuel supply to the distributor-pump plunger is interrupted.



If engine continues to run although there is no voltage at the solenoid-operated valve, operate the emergency shutoff lever at the injection pump (arrow).



12.2.1 Check solenoid-operated valve

Remove fuel-injection tubing.

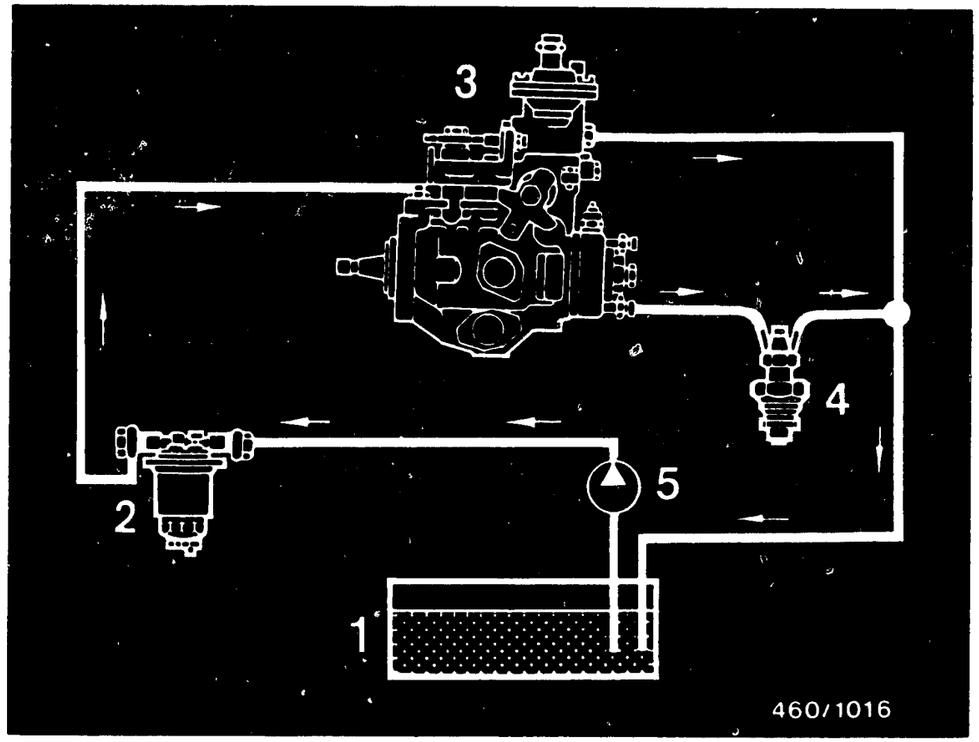
Remove solenoid-operated valve.

Pay particular attention to c l e a n l i n e s s!

Test the functioning of the solenoid-operated valve when it is removed.

Note:
Voltage must be applied only briefly to the solenoid-operated valve when removed since there is no cooling effect from the fuel.

Check the valve seat in the distributor head (visual inspection).

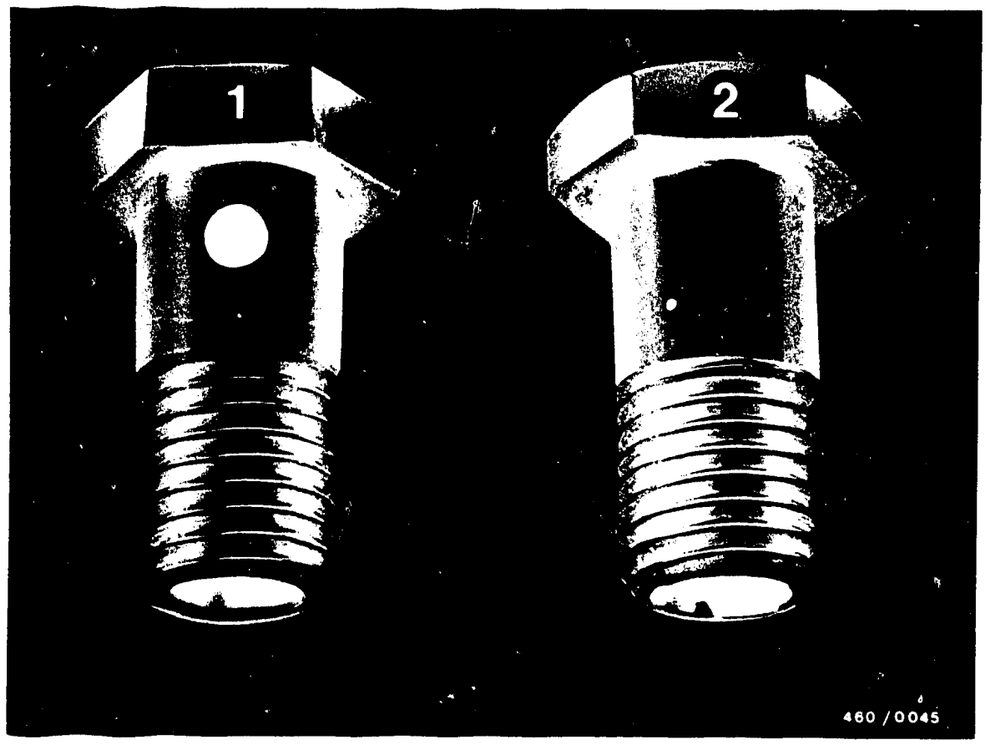


1 = Fuel tank
2 = Fuel filter
3 = Distributor-type fuel-injection pump
4 = Injection nozzles
5 = Fuel pre-supply pump

13. FUEL-LINE DIAGRAM

The fuel lines are connected per the diagram above. #

The fuel flows in the direction indicated by the arrows. #



With regard to the connections of the fuel-injection pump, make sure that the inlet-union screw for fuel inlet (1) and the throttle screw for fuel return (2) do not get mixed up.

The throttle screw is located on the cover of the fuel-injection pump, and is marked on its head with the word "OUT".

14. BLEEDING FUEL SYSTEM (324d)

Fill up the fuel filter and fuel-injection pump with diesel fuel.

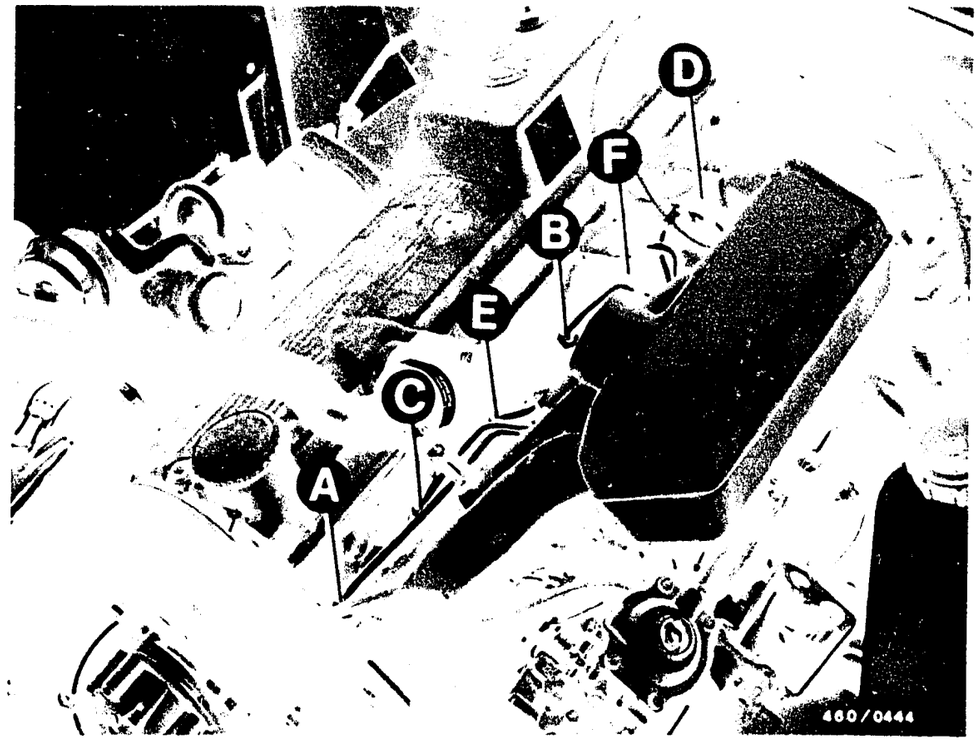
Tighten hose connections on filter cover.

Close bleeder screw on fuel filter (arrow).

Loosen bleeder screw on fuel-injection pump and screw out a few turns (arrow).

Operate engine starting motor without pre-heating.

Re-tighten bleeder screw when the fuel flowing out of the bleeder hole on the injection pump is free of bubbles.

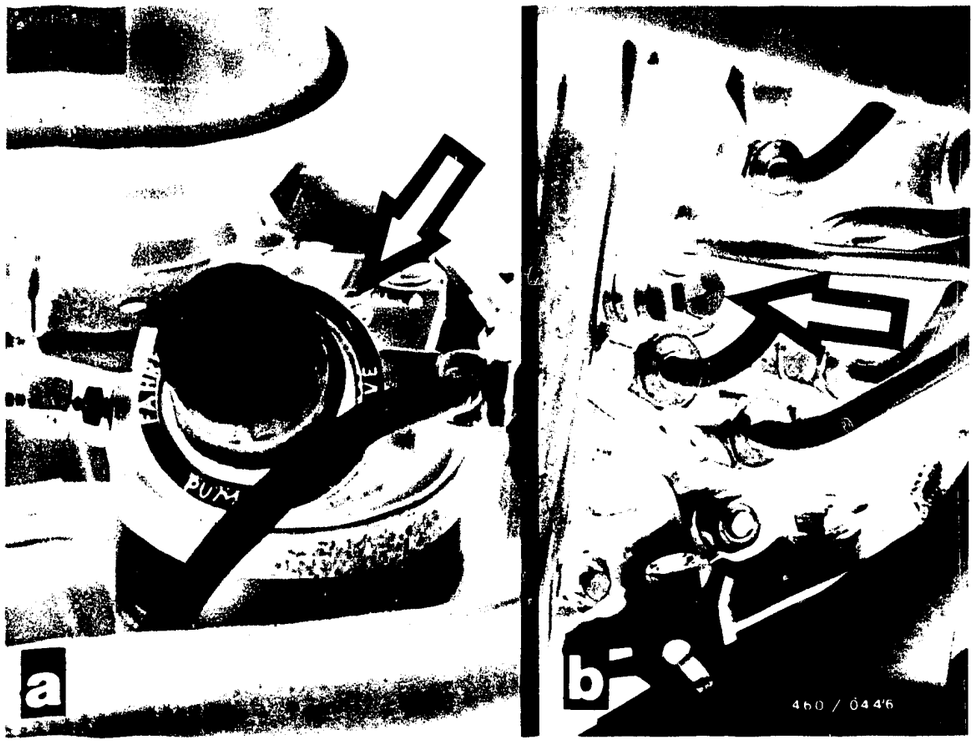


Loosen union nuts of fuel-injection lines (A...F) at the injection-nozzle holders.

Operate engine starting motor until fuel exits at the union nuts of the injection-nozzle holders.

Tighten union nuts.

Operate starting motor until engine starts.



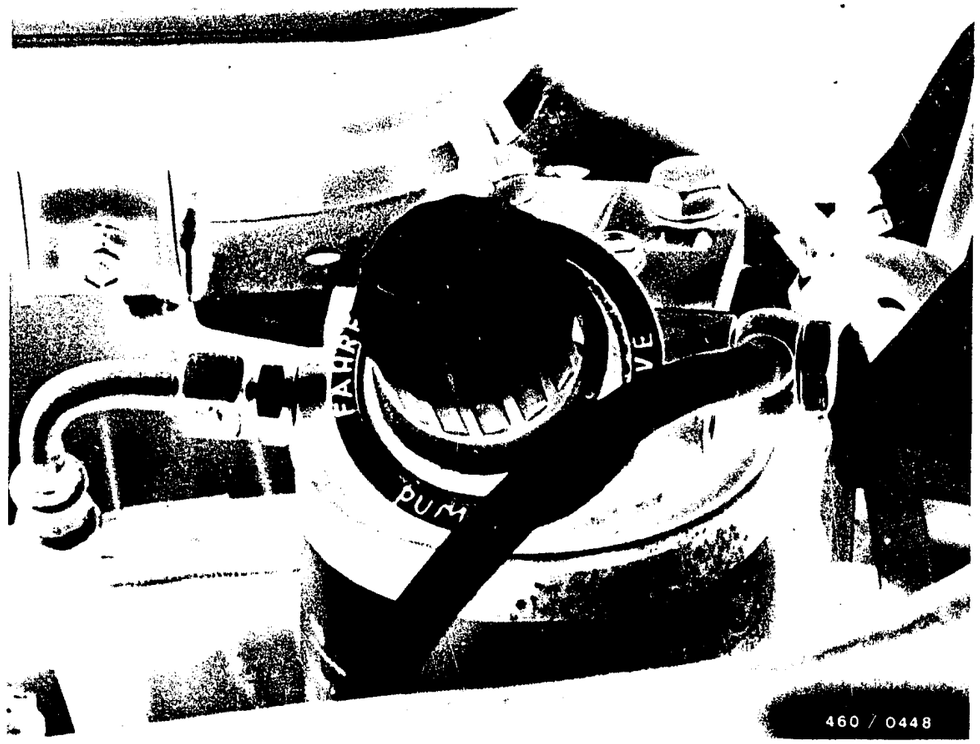
14.1 Bleeding fuel system (524td)

Fill up fuel filter and fuel-injection pump with diesel fuel.
Loosen bleeder screw at fuel filter (figure a – arrow) and fuel-injection pump (figure b – arrow) by a few turns.

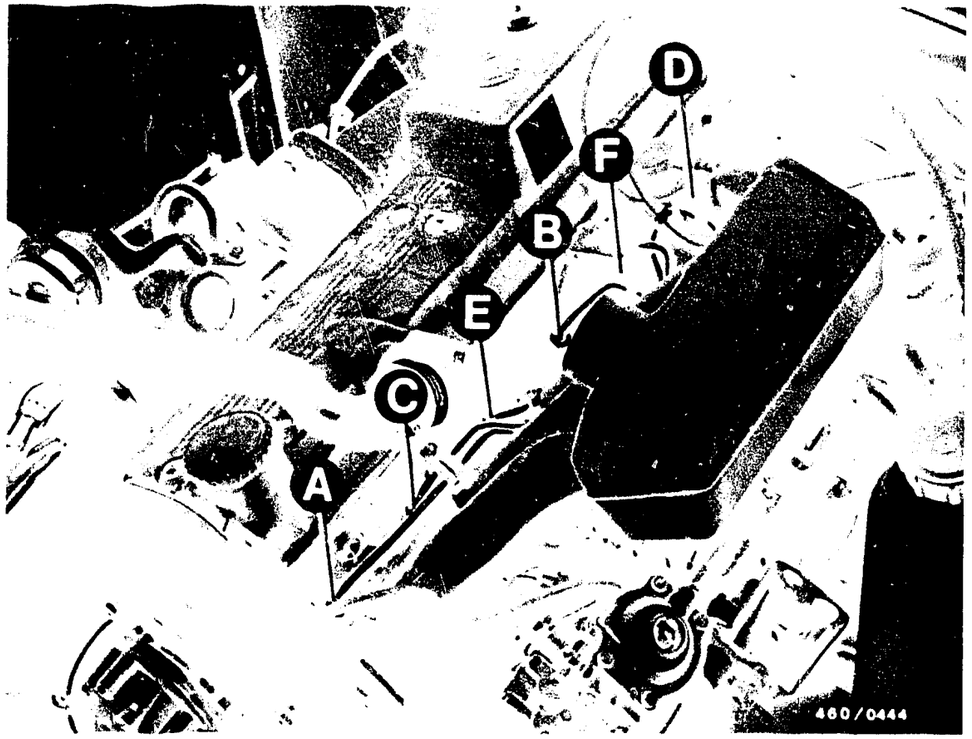
Turn the hand primer at the fuel filter into the pump position (arrows in vertical position).

Operate hand primer until fuel exiting at the bleeder screw of the fuel filter is free of bubbles.

Tighten bleeder screw on fuel filter.
Continue to operate hand primer on fuel filter until bubble-free fuel exits at the bleeder screw of the injection pump.
Tighten bleeder screw on fuel-injection pump.



Turn hand primer by 90° so that the bypass valve in the fuel-filter head is opened.

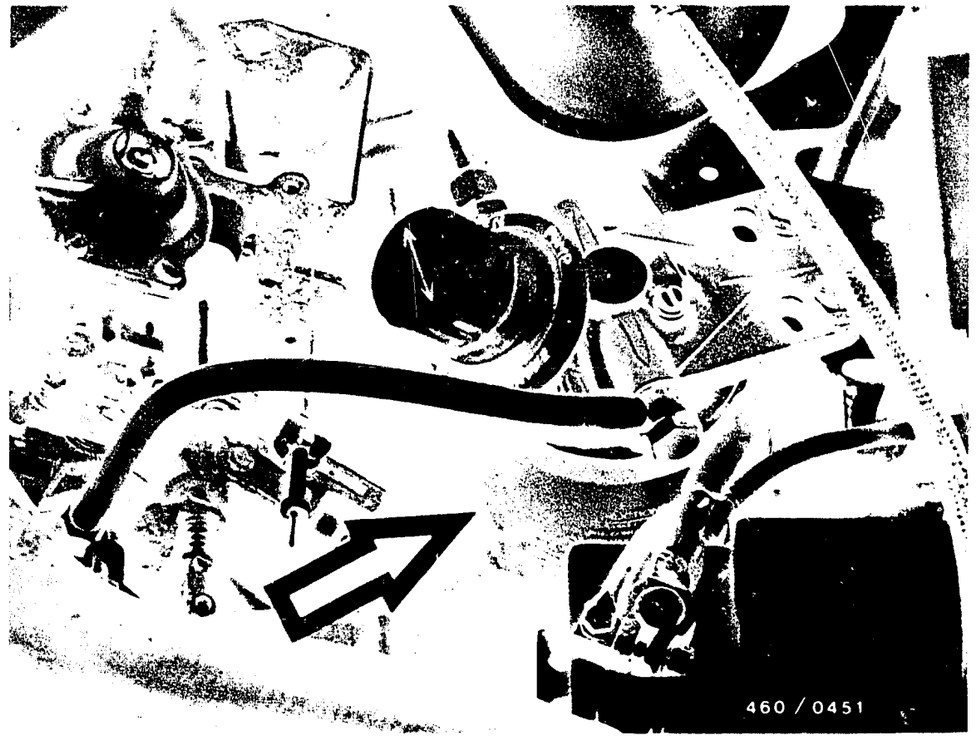


Loosen union nuts for fuel-injection lines (A...F) at the injection-nozzle holders.

Operate the engine starting motor until fuel exits at the union nuts of the injection-nozzle holders.

Tighten union nuts.

Operate starting motor until engine starts.



15. REPLACING AND DRAINING FILTER BOX

15.1 Replacing filter box

Screw filter box (arrow) out of filter cover.

If filter box is tight, loosen with a special wrench, e.g. Matra W 167.

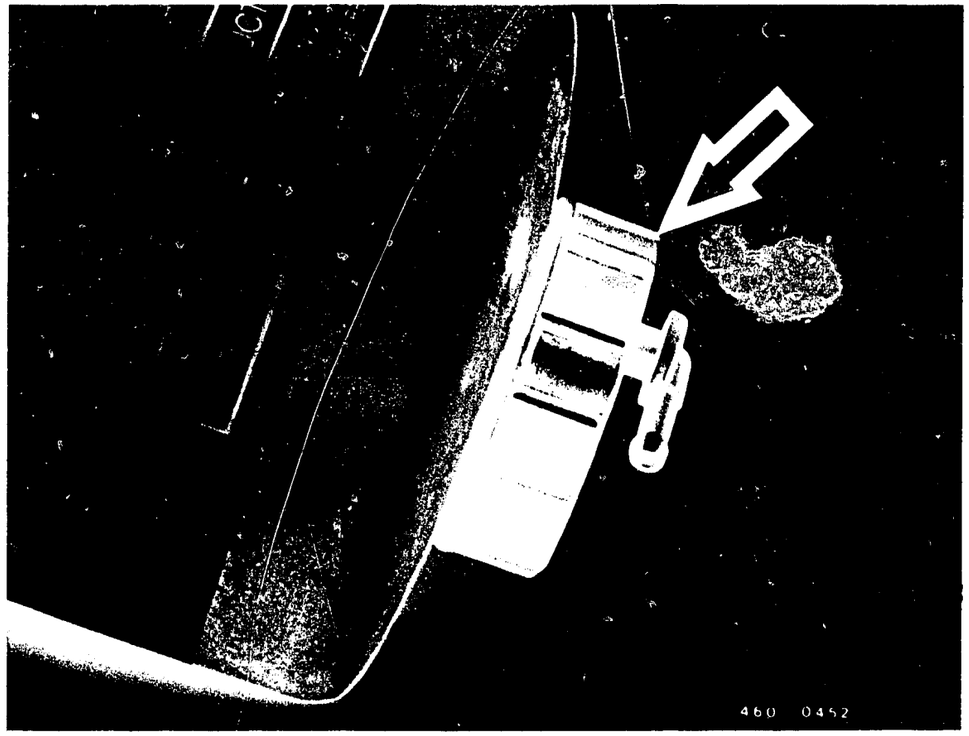
Catch escaping fuel.

Rub diesel fuel into the rubber seal (arrow) of the new filter box.

Screw filter box into cover by hand and tighten.

Check fuel filter for sealing.

With winter fuel, it may be necessary to add kerosene as specified by the vehicle manufacturer.



15.2 Draining fuel filter

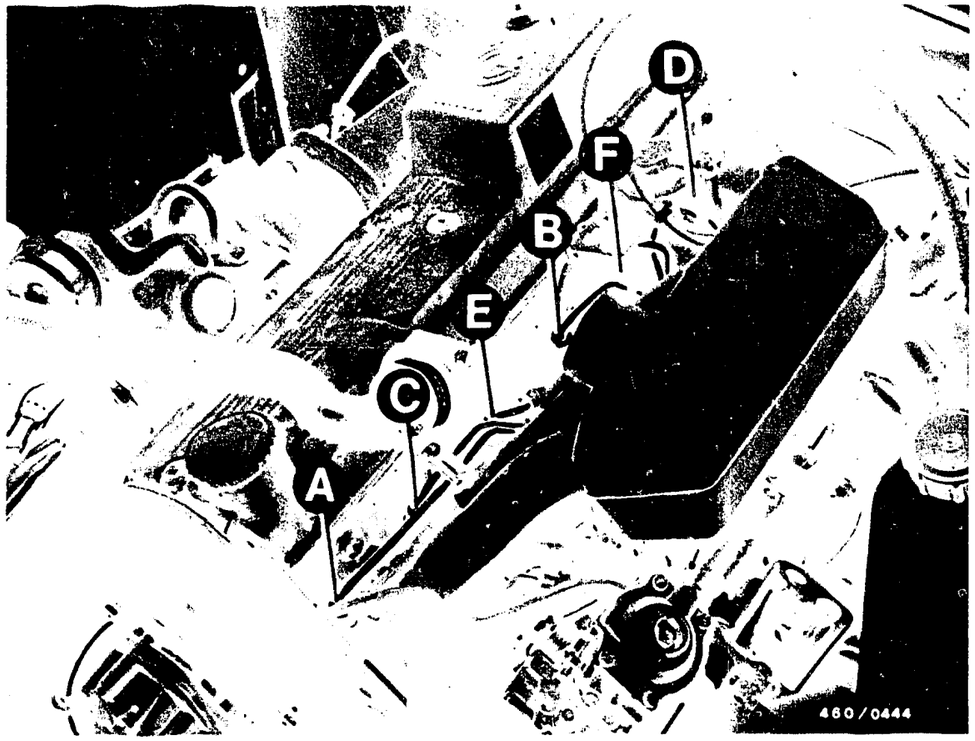
Loosen bleeder screw on filter cover by a few turns.

Loosen water-drain plug on base of filter (arrow) and allow water to drain.

Catch liquid in container.

Tighten water-drain plug and bleeder screw and check sealing.

If necessary, bleed fuel filter.



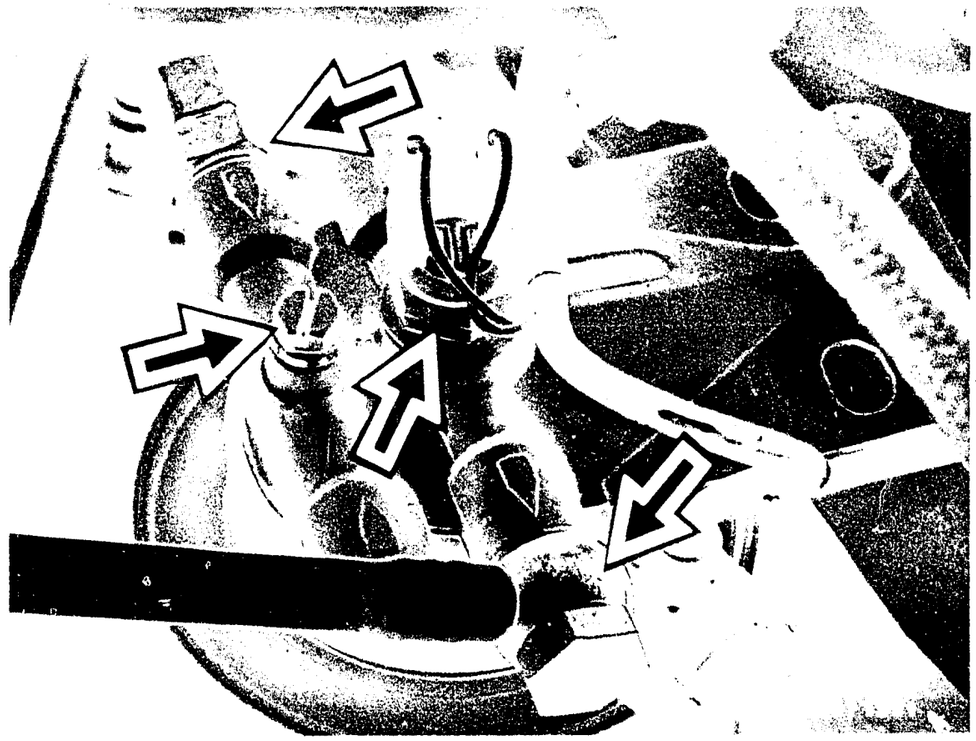
16. LEAK TEST OF FUEL-INJECTION SYSTEM

Carry out leak test with engine at operating temperature.

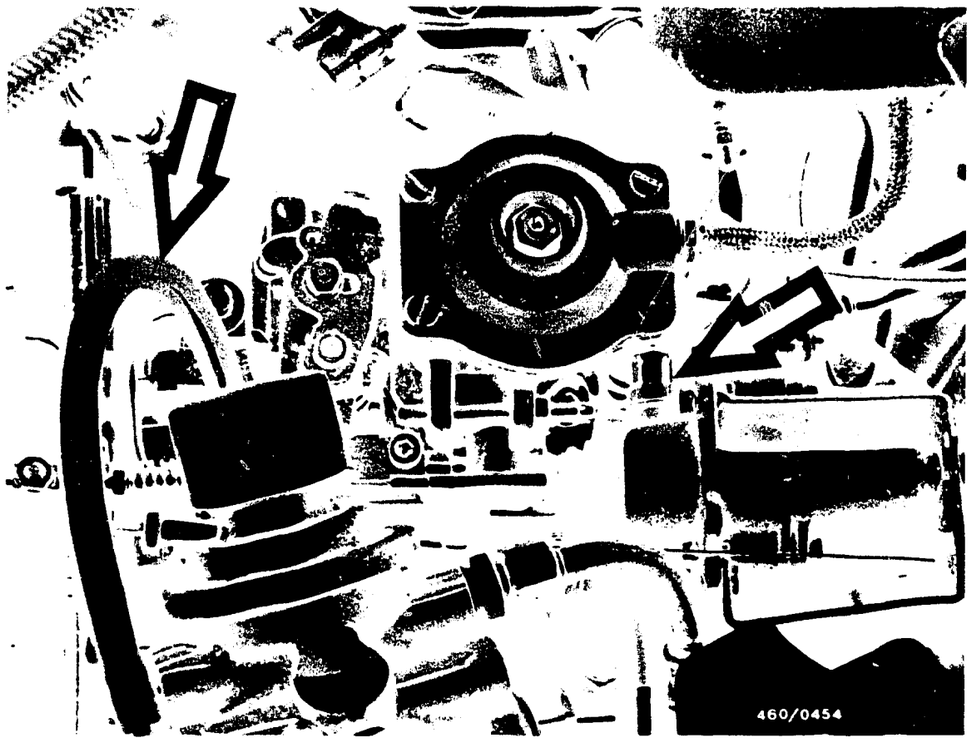
Check all junctions of the fuel lines.

Pay particular attention to:

* Connections at injection-nozzle holders (A...F).



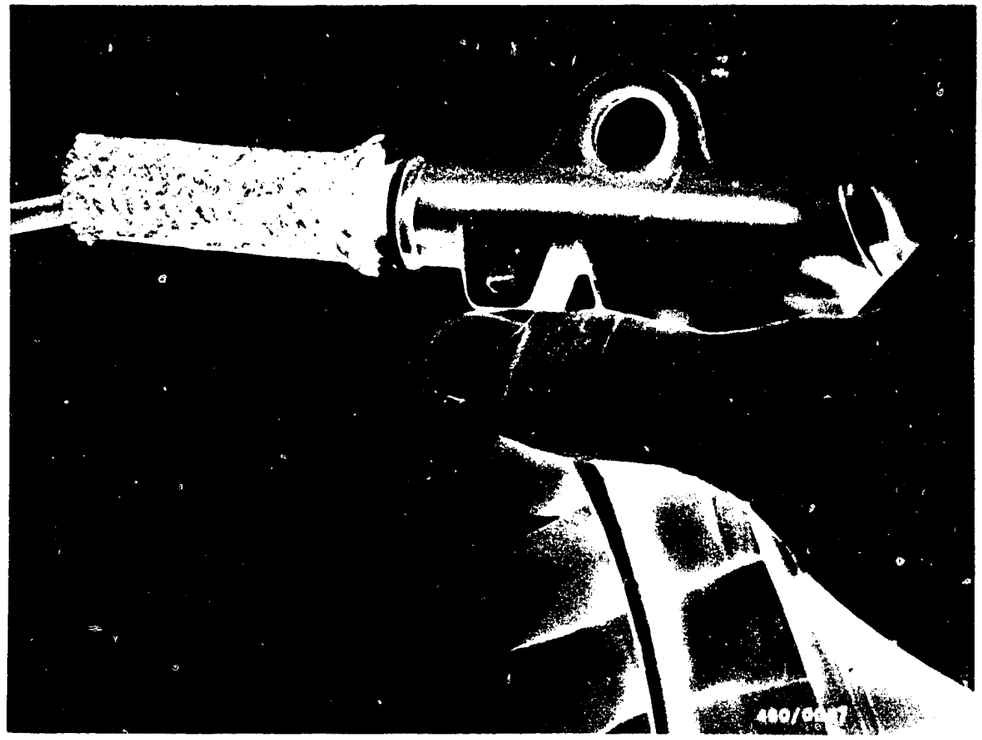
* Connections and threaded junctions on fuel filter (arrows).



* Inlet and return lines on distributor-type fuel-injection pump (arrows).

* Delivery-valve holders on hydraulic head.

Inspect fuel lines for hairline cracks.



17. FUEL-LINE INSPECTION

Carry out visual test of suspect fuel lines.

If no pinching or kinking is found, the fuel line in question must be removed.

Use compressed air to check fuel line for flow-through; if necessary, clean line.

A suitable hose section can be used as a side seal for blowing out the fuel lines.

18. SMOKE TEST – CHECKING AIR FILTER

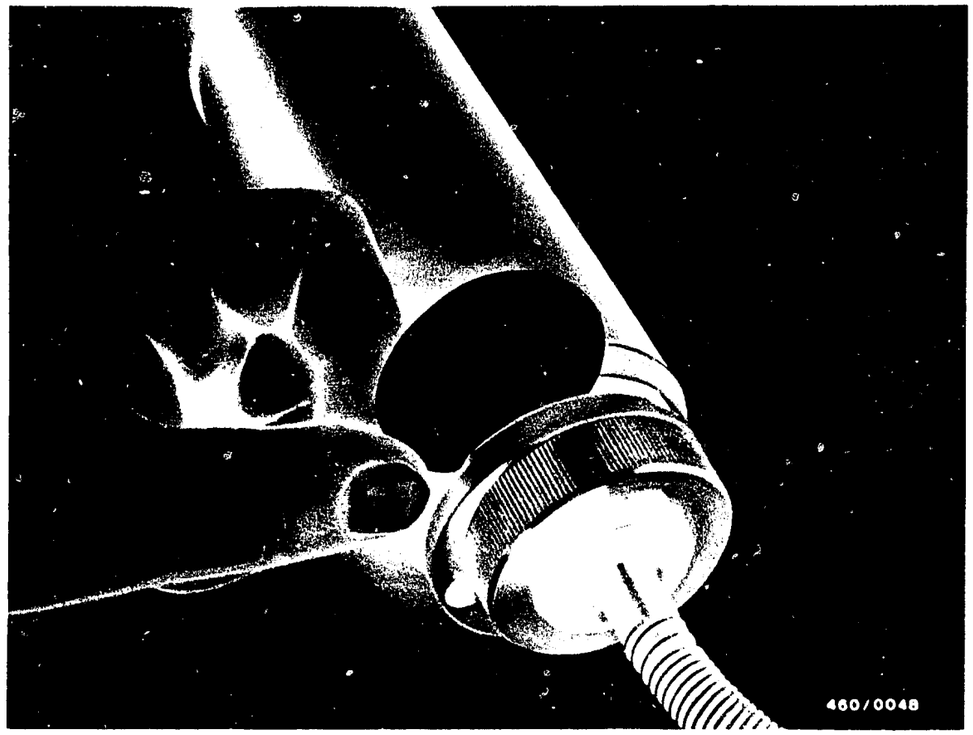
18.1 Smoke test

Summary of the contents of the legal regulations (as of April 1978) (applicable to Federal Republic of Germany):

This regulation applies only to the homologation of motor vehicles having at least 4 wheels with a maximum permissible speed of more than 25 km/h. A smoke emission test is not prescribed for official general inspections.

Parts which may have an influence on environmental pollution must be designed in such a way that the legal requirements are met during operation and despite vehicle vibration.

This applies in particular to cold-start devices and full-load stops.
The Rheinland-Westfälischer TÜV (Technical Inspection Bureau of the federal state of Rheinland-Westphalia) in Essen is the sole approval agency.



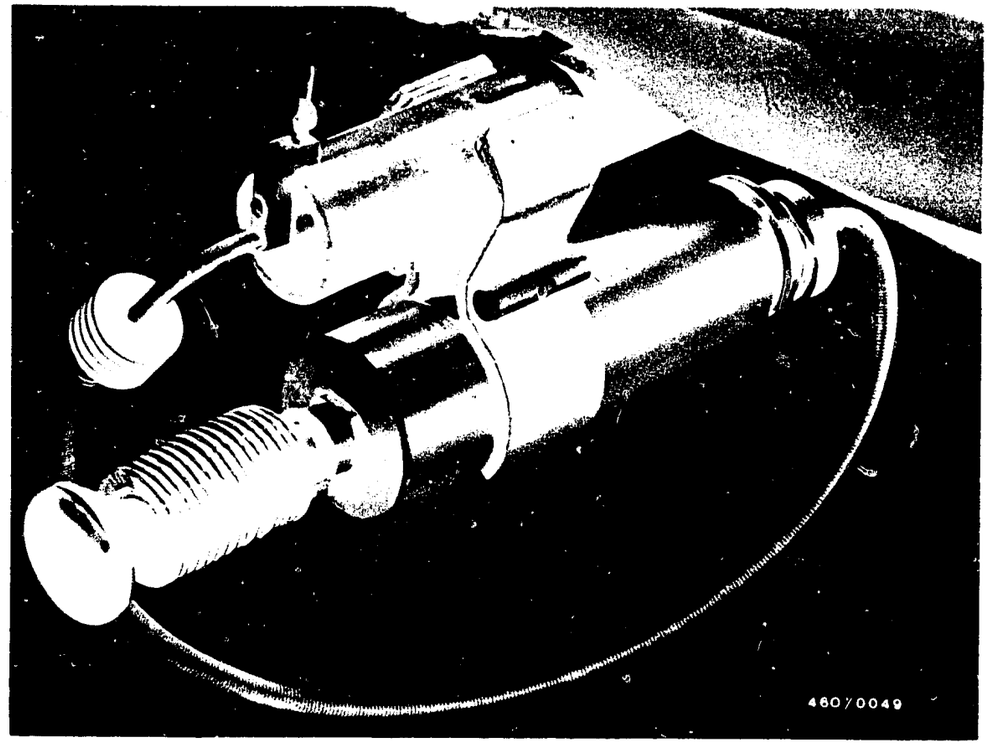
18.1.1 Test setup

Smoke testing is carried out using the BOSCH smokemeter.

The smokemeter consists of the following units:

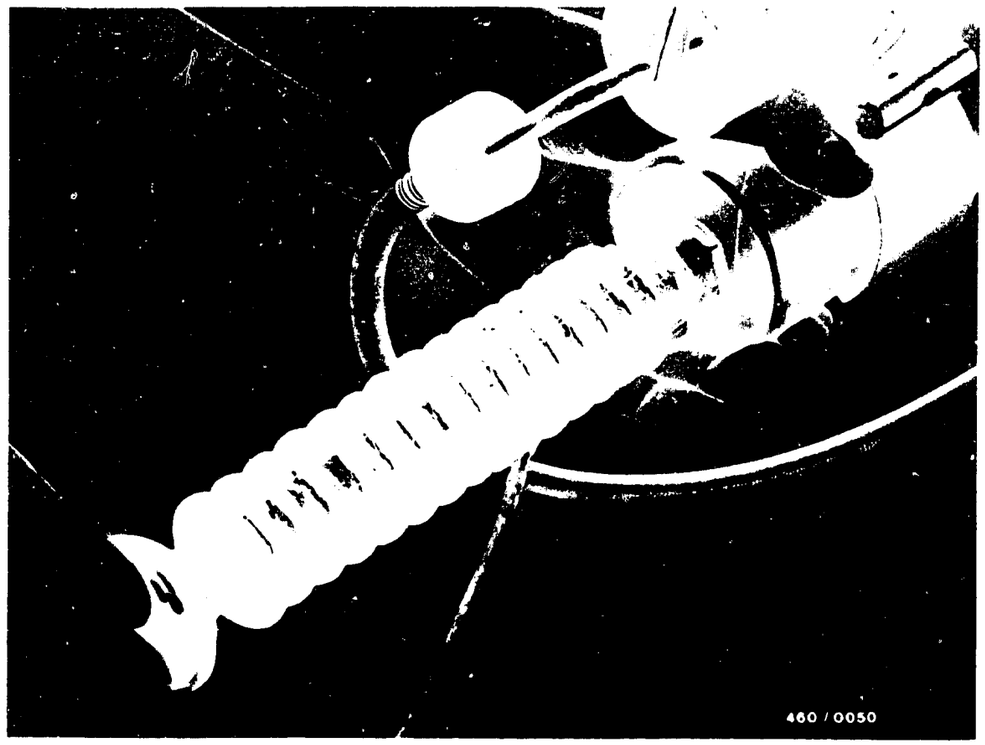
* Accessories box with proportioning pump 0 681 169 038
* Evaluating unit 0 684 102 050

Insert filter plate into proportioning pump.



Affix proportioning pump to exhaust pipe using suitable clamp.

Guide exhaust sampling pickup into exhaust pipe as far as possible and clamp in position.



18.1.2 Test procedure

Set proportioning pump by pressing in the black push-button.

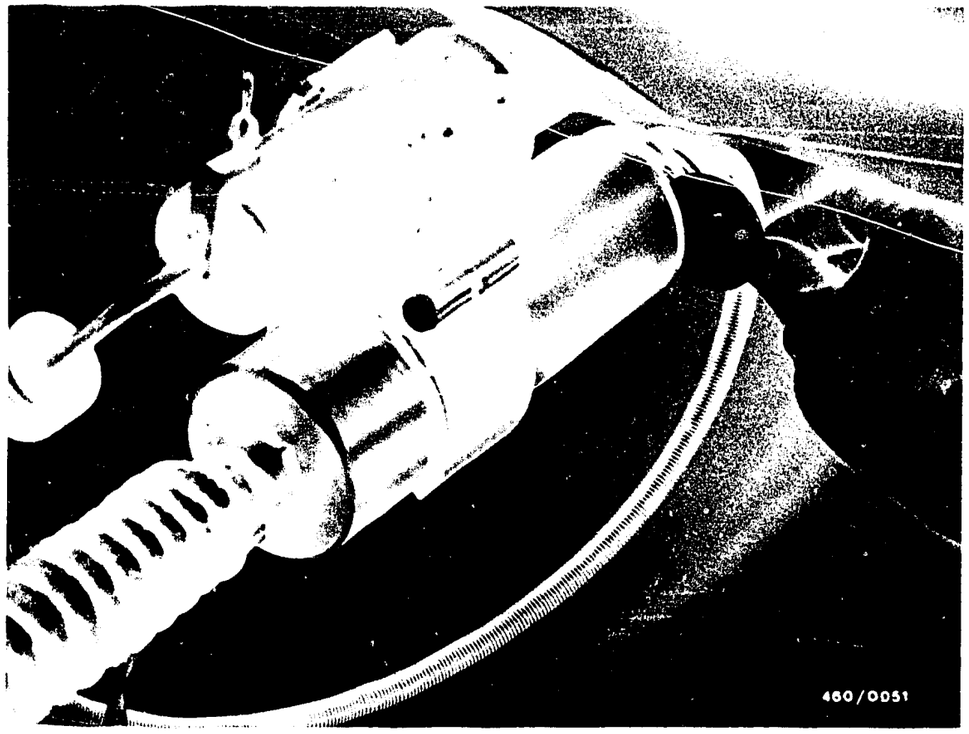
Take rubber ball on triggering hose into passenger compartment of vehicle.

Tests can be performed on a chassis dynamometer or on the road (gradient).

The chassis dynamometer is always preferable.

Find the gear in which a speed of about 40 km/h is reached with the accelerator pedal in the full-load position.

Load the engine so that the speed drops to about 25 km/h with the accelerator pedal in the same position.



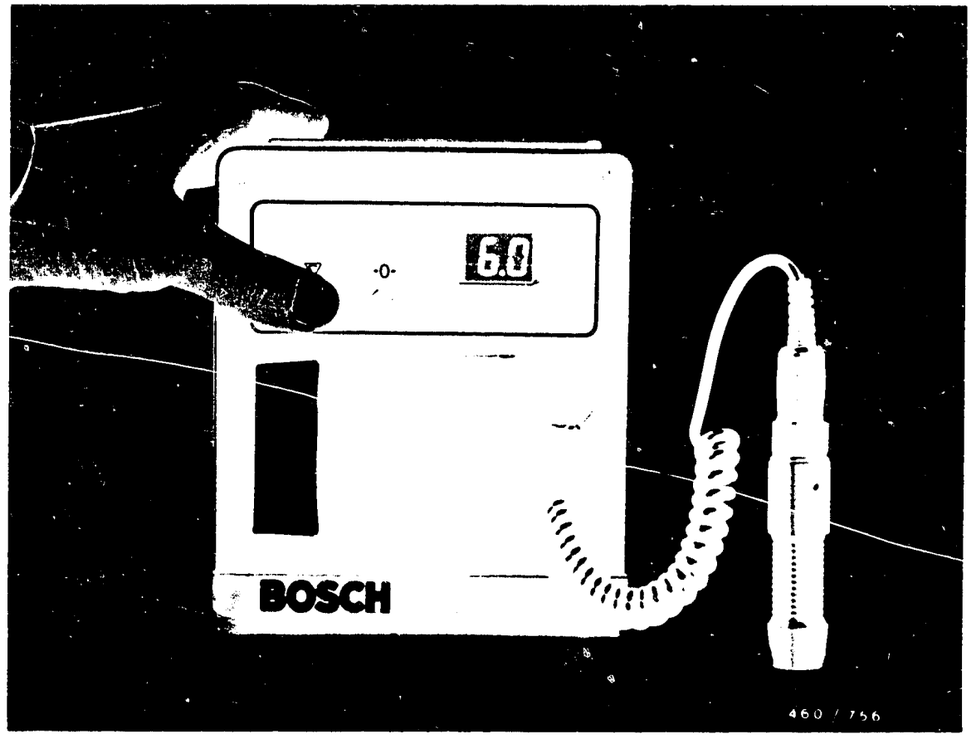
Maintain this load condition for 5 seconds and then trigger the sampling pump by pressing the rubber ball.

Switch off engine.

C a u t i o n !

<u>During the following operation, be aware of the fact that the exhaust pipe has been heated by the running of the engine.</u>

Remove filter plate from sampling pump.



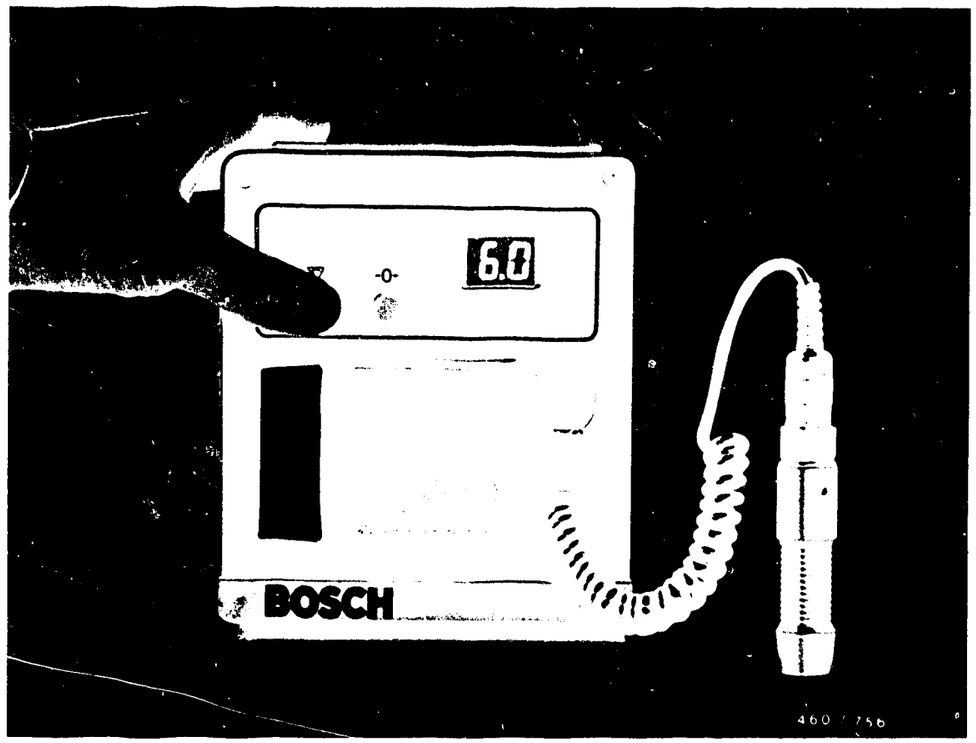
<u>Zero setting</u>

Zero adjustment must be carried out:

* before every test series
* upon alteration of surrounding conditions
* after every cleaning of the photovoltaic-cell adapter.

Firmly press the measuring head of the photovoltaic-cell adapter onto 5 superimposed clean white filter plates.

Press button "0" until the display reads 0.0.
Release button "0".



Measuring

Lay filter plate from sampling pump on top of 3 superimposed new filter plates with the soot side up.

Press measuring head vertically onto the black surface of the filter plate, at the same time pressing button "C", until the measured opacity number appears in the display.

Note:

Both in zero-point calibration as well as in measuring, the measuring head must be f i r m l y applied (even slight tilting can lead to incorrect measurement).

Compare the opacity number thus obtained with the evaluation sheet, noting the kW (bhp) information provided by the vehicle manufacturer.

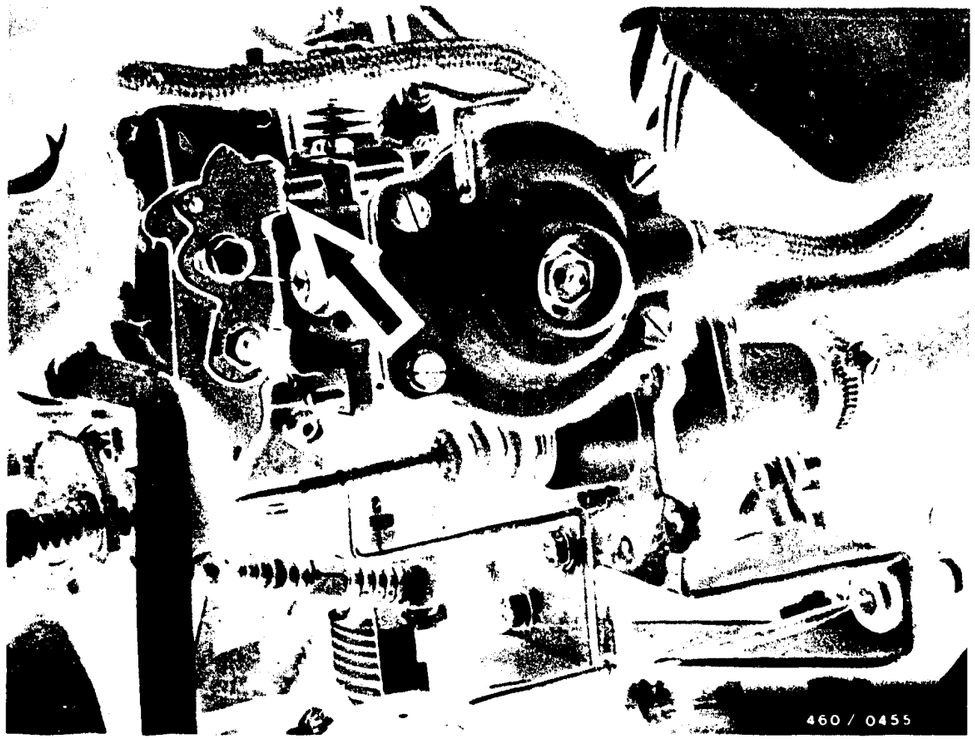
18.2 Inspecting air filter

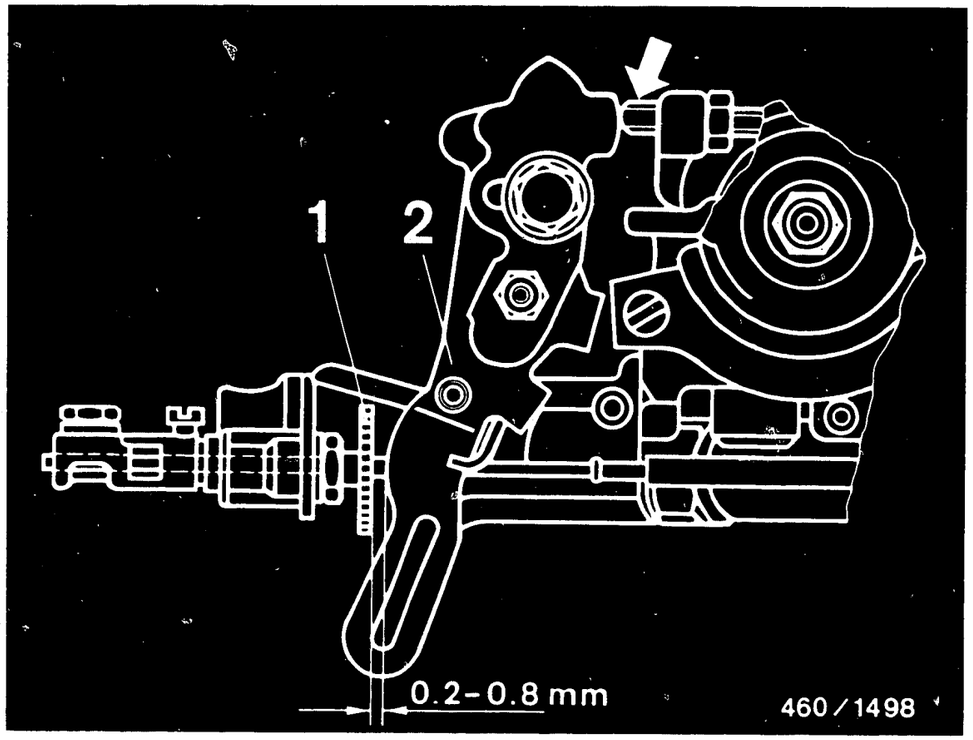
Remove the air filter and subject it to a visual inspection.

Test criteria for air filter

* If air filter clogged with dust -> knock out
* If air filter contaminated with oil -> replace
* Remove any solid object (e.g. leaves) in the air filter.

When in doubt, replace the filter cartrige.





1 = Knurled-head screw 2 = Control lever

19. ADJUSTING IDLE SPEED
(On vehicles with manual or automatic transmission)

Connect a tachometer (photoelectric, for example) to the engine.
For this purpose, apply a reflex mark to the crankshaft. Aim the digital hand tachometer at the reflex mark and optically measure the engine speed. Start engine and let run at idle speed.

I m p o r t a n t !

The engine must be at normal operating temperature (engine oil > + 60° C) for adjusting the idle speed.

The temperature-controlled idle increase must be inoperative.

The control lever rests against the idle-speed adjusting screw (arrow).

Use the idle-speed adjusting screw (arrow) to adjust the idle speed to
750 + 50 min $^{-1}$.

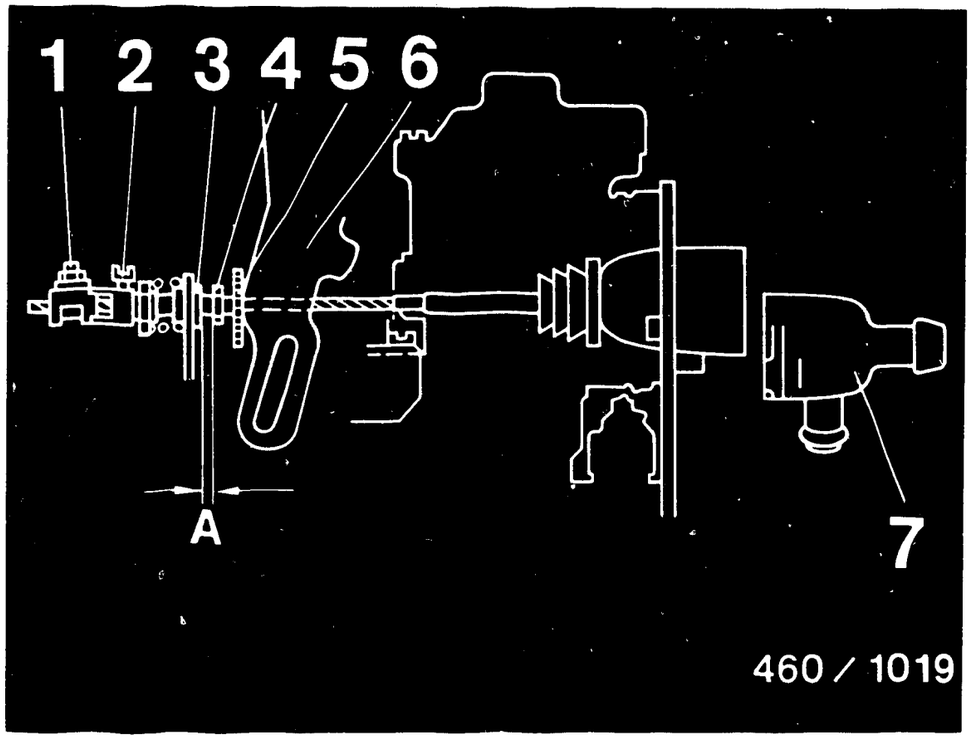
Turn the knurled-head screw until there is a play between the screw and the control lever of 0,2...0,8 mm.

Note:

The engine camshaft and injection pump are driven at half the engine speed.

After adjustment, lock and seal the adjusting screw.

After adjustment of the idle speed, check and if necessary adjust the play of the bowden cable for the accelerator pedal and the position of the engine-speed control lever (only on vehicles with automatic transmission).



19.1 Adjusting idle increase
Checking overall travel

Remove the housing for the temperature-dependent idle increase (7).

Measure dimension "A" between the locknut of the knurled-head screw (4) and the band of the angle bracket (3).

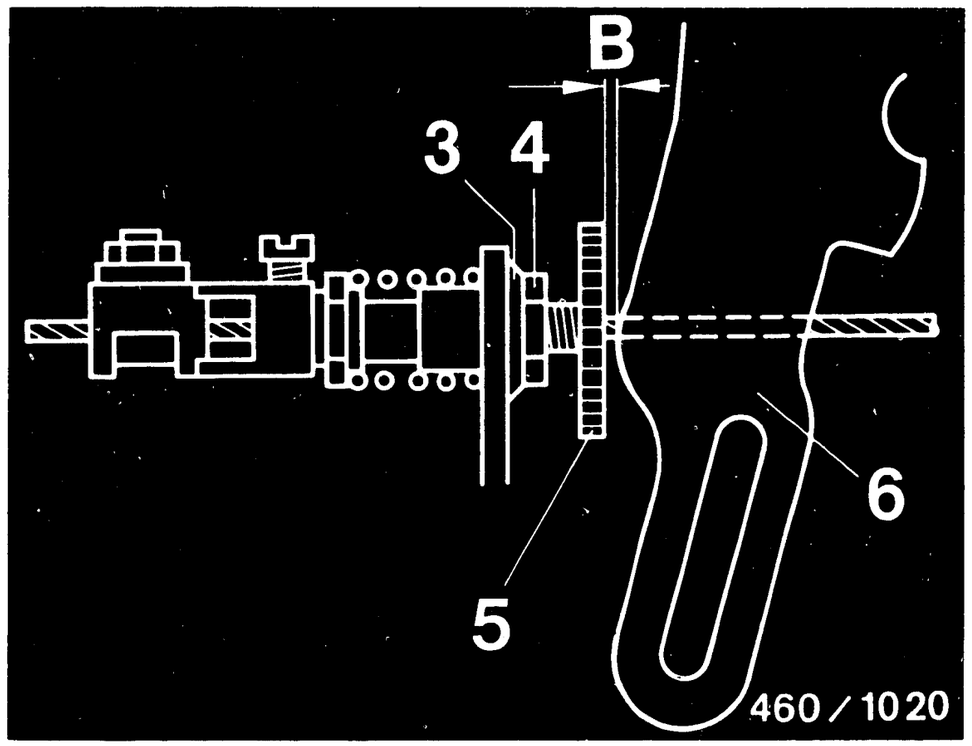
Nominal value: 5,1 ... 5,9 mm

In measuring, the control lever (6) must rest against the knurled-head screw (5).

Adjustment:

Loosen the clamping piece (1 and 2) and push it until dimension "A" is within tolerance.

Fasten clamping piece (1) first, and then clamping piece (2).
Mount housing (7).



19.2 Checking and adjusting clearance from control lever to knurled-head screw.

Adjusting with engine warm

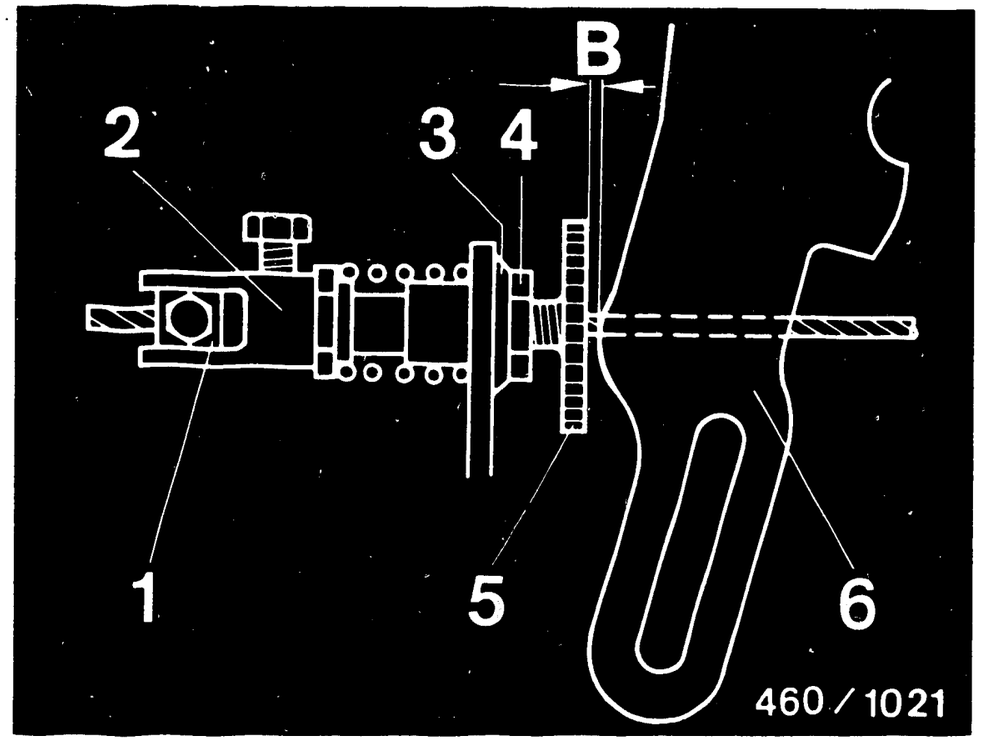
Prerequisites:

* Warm idle-speed setting OK.
* Coolant temperature > 25°C.
* Lock nut (4) rests against collar (3).
* Control lever (6) resting against idle-speed adjusting screw.

Measure clearance "B" between control lever (6) and knurled-head screw.

Nominal value: B = 0,2...0,8 mm

If the nominal value is not reached, loosen lock nut (4) and turn the knurled-head screw (5) until dimension "B" lies within tolerance.



19.3 Checking and adjusting clearance of control lever to knurled-head screw

Adjustment with engine cold
Loosen clamping piece (2) and turn by 90° (clamping piece (2) slides over clamping piece (1)).

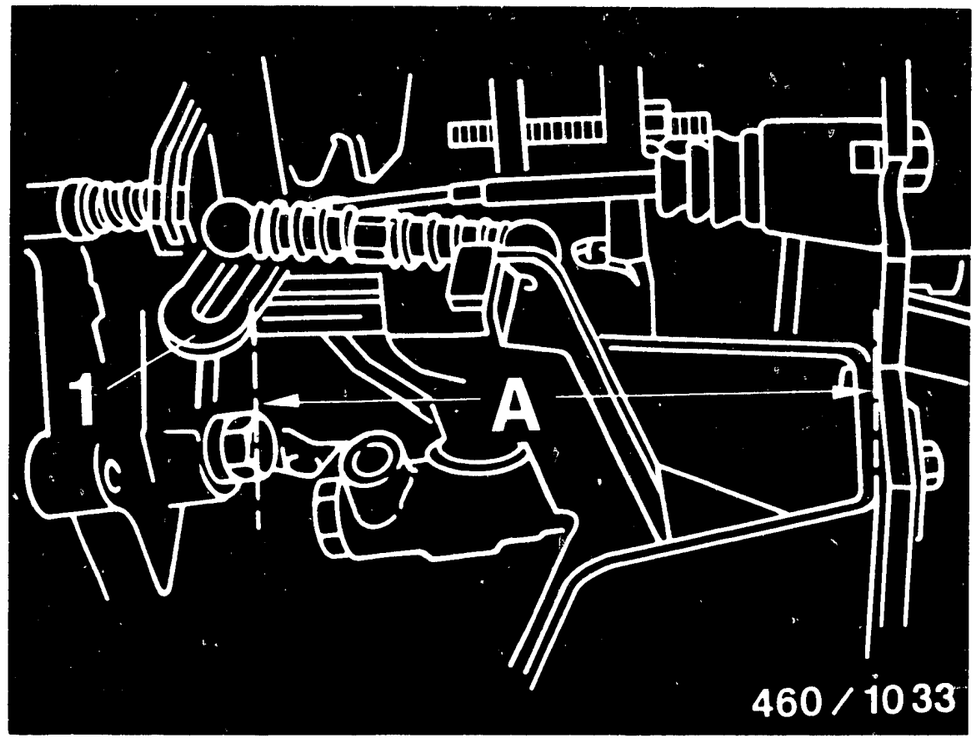
Prerequisites:
* Warm idle-speed setting OK.
* Lock nut (4) resting against collar (3).
* Control lever (6) resting against idle-speed adjusting screw.

Measure clearance "B" between control lever (6) and knurled-head screw (5).

Nominal value: B = 0,2...0,8 mm

If the nominal value is not reached, loosen lock nut (4) and turn knurled-head screw (5) until dimension "B" lies within tolerance.

Turn clamping piece (2) by 90° again and fasten.



20. ADJUSTING ENGINE-SPEED CONTROL LEVER
(Only on vehicles with automatic transmission)

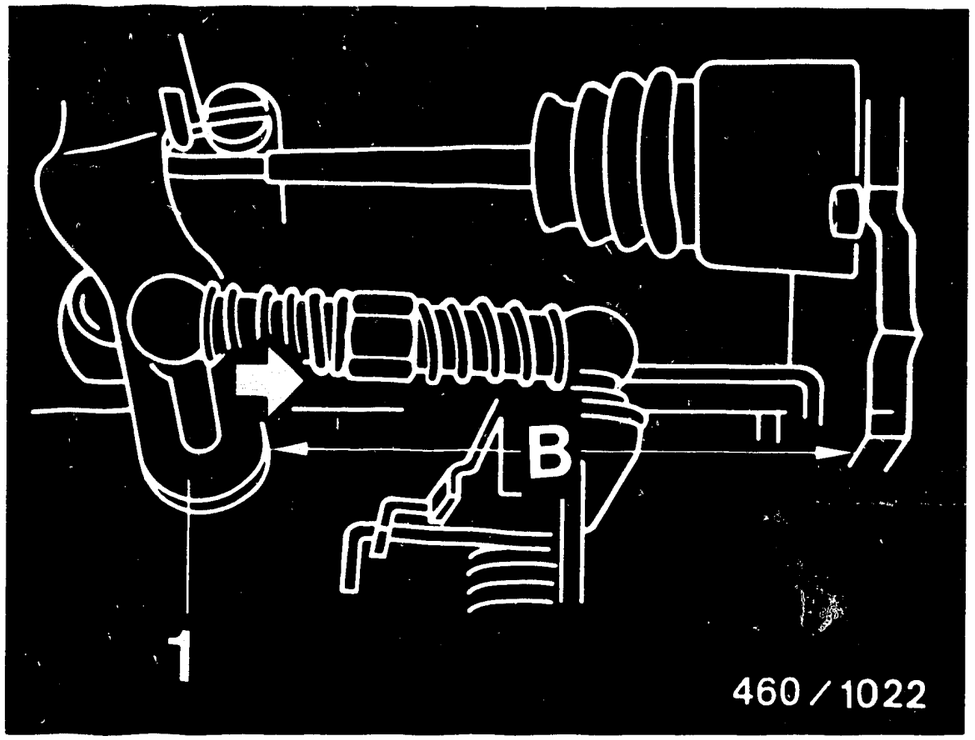
Prerequisites:

* Idle speed correctly set.

* Engine at normal operating temperature.

* Control lever (1) resting against idle stop.

Measure and note down dimension "A".



Press control lever (1) against full-load stop.

Measure and note down dimension "E".

Subract dimension "B" from dimension "A".
A – B = C

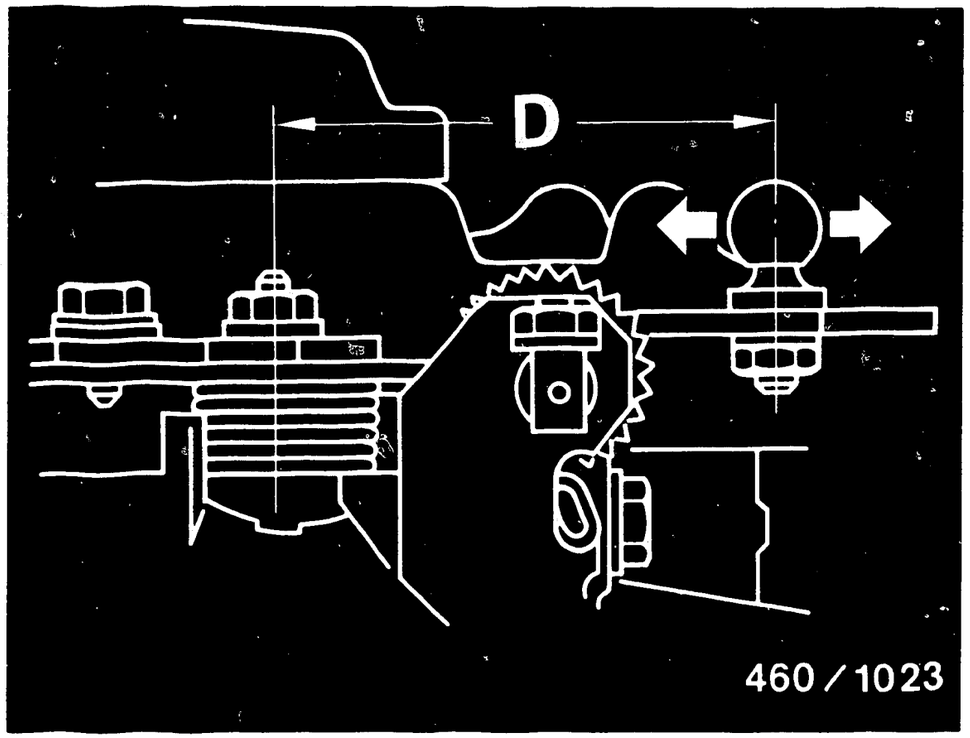
Example: A = 98 mm
B = 47 mm
C = 51 mm

If the calculated value of C = 51 mm,
then dimension "D" from the table = 61.6 mm.

Derive dimension "D" for the adjusting linkage from the following table.

Adjustment table:

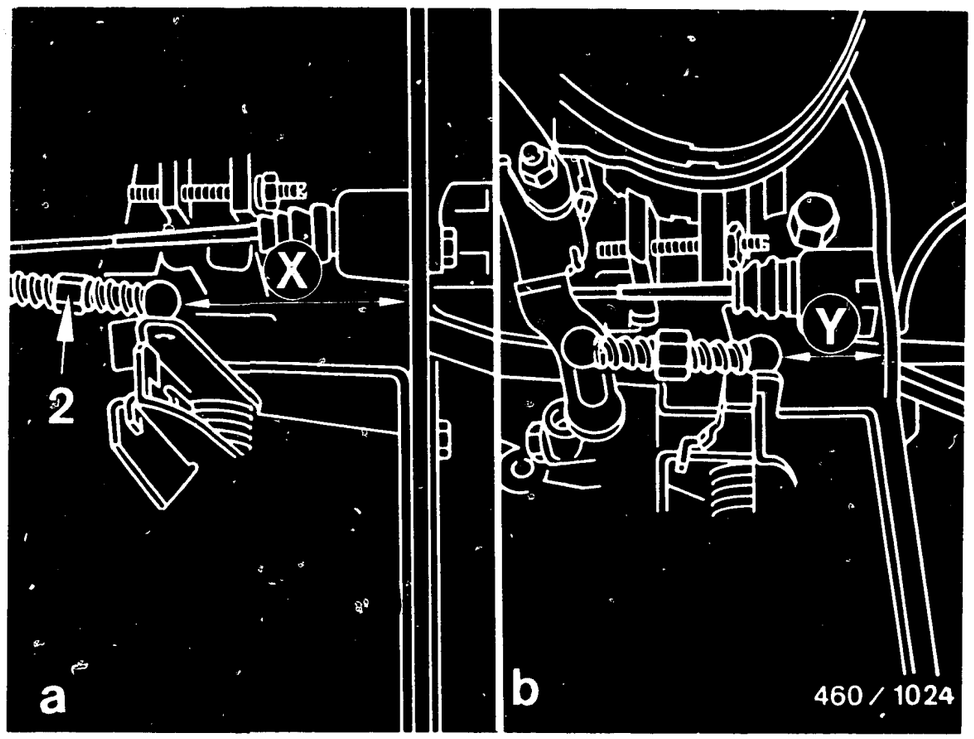
C	(mm)	41	41.5	42	42.5	43	43.5	44	44.5
D	(mm)	78.1	77.0	76.0	74.9	73.9	73.0	72.0	71.1
C	(mm)	45	45.5	46	46.5	47	47.5	48	48.5
D	(mm)	70.3	69.4	68.6	67.8	67.0	66.3	65.6	64.9
C	(mm)	49	49.5	50	50.5	51	51.5	52	52.5
D	(mm)	64.2	63.5	62.9	62.3	61.6	61.0	60.5	59.9
C	(mm)	53	53.5	54	54.5	55	55.5	56	
D	(mm)	59.4	58.8	58.3	57.8	57.3	56.8	56.4	



Disengage the connecting linkage at the control lever.

Measure dimension "D" and compare with adjustment value from table.

If necessary, adjust dimension "D" by altering the ball head (arrows).

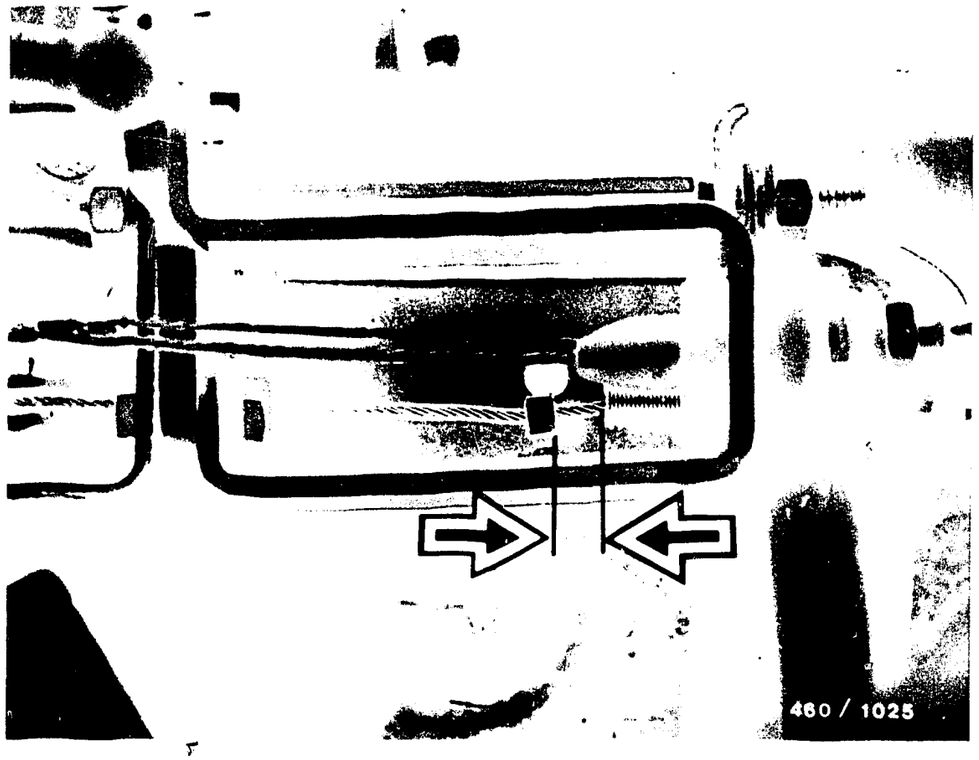


1. Check dimension "X" in idle position.
   Figure (a)
   Setting dimension = 68 ± 0.5 mm
   Correct setting at connecting linkage (2).

2. Check full-throttle position (figure b).
   Dimension "Y" must be 28.1 ... 29.1 mm.
   If dimension "Y" is incorrect, repeat the entire setting process.

Note:

After coordination of the engine-speed control lever to the lever position of the automatic transmission, check the adjustment of the bowden cable for the accelerator pedal (adjust).



21. KICK-DOWN ADJUSTMENT

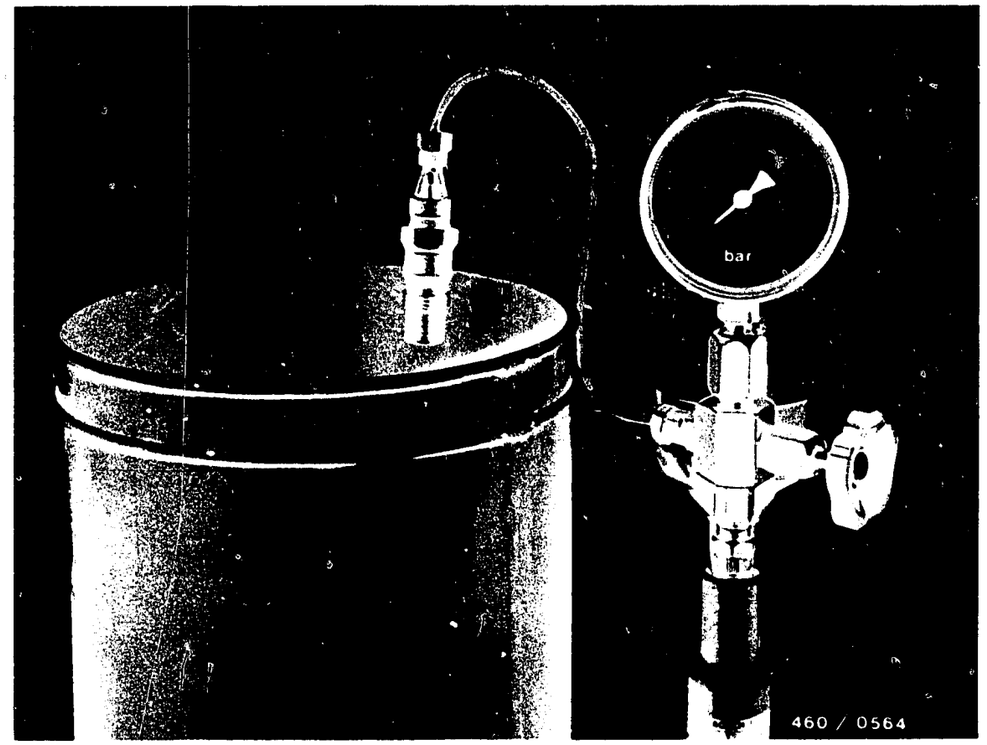
Prerequisite:

* Engine at normal operating temperature, coolant-water temperature + 78°C

Adjustment:

1. At idle speed, there must be a clearance between the bowden cable and guide sleeve of 0.5 mm.

2. Switch off engine, depress accelerator pedal down to the kick-down point, setting dimension between cable clamp and guide sleeve = 30 mm. Adjust by alteration of the guide sleeve.



22. TESTING INJECTION NOZZLES

Remove injection nozzles.

Testing is carried out with the nozzle tester EFEP 60 H 0 681 200 502.

Mount injection nozzle with nozzle-holder assembly on nozzle tester.

In order to make sure that the nozzle is not improperly mounted, firmly move the hand lever of the nozzle tester a few times with the pressure gauge switched off (approx. 4 to 6 downward movements per second).

Note:

When testing injection nozzles, make sure that the fuel stream does not get on the hands, since the high pressure can cause the fuel to penetrate the skin and cause blood poisoning.

For testing, use pure calibrating oil per ISO 4113 or clean diesel fuel.

Test criteria:
* Opening pressure
* Sealing
* Chatter behavior
* Spray pattern

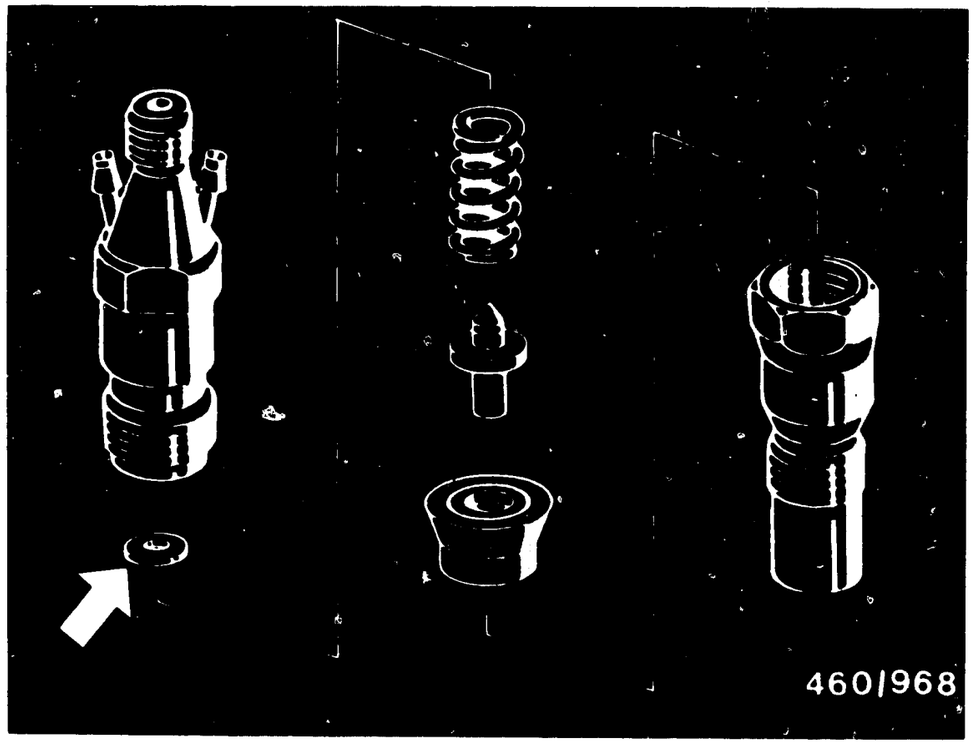
22.1 Testing opening pressure

Open shutoff valve on pressure gauge about 1/4 turn.

Slowly depress the hand lever of the nozzle tester (pressure rise at pressure gauge).

Observe the pressure at which the indicator of the pressure gauge stays (nozzle chatters).

The highest pressure reached in this process is the opening pressure.



If there is deviation from the nominal value, correct the nozzle-opening pressure with shims behind the pressure spring (arrow).

Nominal value:

Opening pressure (new nozzles):	150 + 8 bar
Opening pressure (used nozzles) min.:	135 bar
Maximum pressure difference.	15 bar

Thicker shims = higher nozzle-opening pressure
Thinner shims = lower nozzle-opening pressure

+/- 0.05 mm change in spring travel causes a change in the nozzle-opening pressure of about 5.0 bar.

22.2 Leak test

Open shutoff valve on pressure gauge about 1/4 turn.

Dry off the lower part of the nozzles and the nozzle holder (blow-dry with air).

Slowly depress hand lever until pressure gauge shows 20 bar less than the opening pressure previously indicated.

There is no leakage at the nozzle when no drop drips from the nozzle outlet within 10 seconds.

If a drop does drop off, disassemble and clean the nozzle-and-holder assembly.

If there is still leakage, replace the nozzle.

Do not dress or rework the nozzle parts themselves.

Note:

Furrowing on the holder and intermediate washer can be refinished if appropriate care is used (except during the warranty period).

22.3 Chatter testing, evaluation of spray pattern

General:

When evaluating the nozzles, a distinction must be made between new and used nozzles.

Switch off the pressure gauge.

New nozzles:

Chatter testing makes it possible to carry out a listening test of the nozzle needle for freedom of movement within the holder.

If the nozzle does not chatter, despite cleaning, replace it with a new nozzle.

The spray pattern has no significance in chatter testing.

A spray pattern corresponding to the specification is generally obtained only from new nozzles.

Used nozzles:

Due to wear in the seat area, the chatter behavior of the nozzle changes for the worse. The nozzle must chatter audibly and/or spray with good atomization when the lever is moved quickly.

With used nozzles, the spray pattern can deviate from the ideal pattern of a new nozzle.

However, it is possible to noticeably improve the spray pattern of such nozzles through proper cleaning.

Chatter and spray testing

Flat-type pintle nozzles with throttling effect are installed.

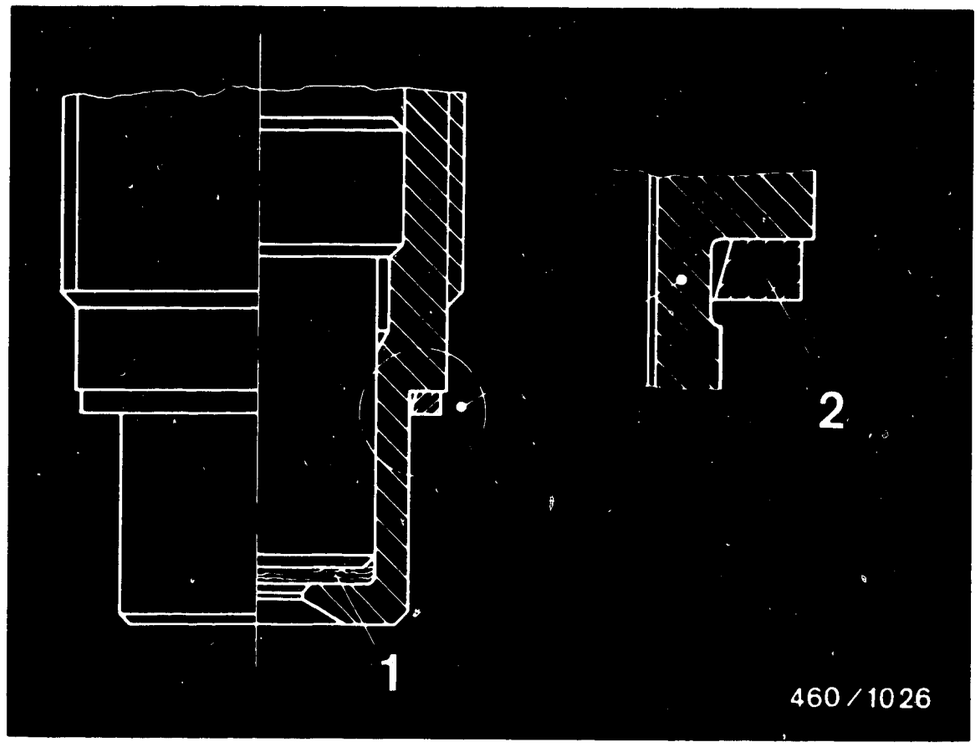
These nozzles have lateral surface grinding at the pintles.
The surface thus attained results in an oval spray shape.

Chatter testing:

Due to its particular constructional features, this nozzle chatters very softly.
With this nozzle, chatter testing is possible only between 1...2 downwards movements per second of the hand lever.
If the test speed is increased, the chattering stops.
The calibrating oil then exits the nozzle with a hissing noise.
The nozzle chatters with a high whistling noise only with quick, jerky movement of the hand lever (about 4...6 downwards movements per second).

Spray pattern (applies only to new nozzles):

Until the high whistling noise is reached, the spray can be very stringy and non-atomized.
In this range, a divided spray and formation of streaks are without significance. In order to evaluate the spray shape, the hand lever is rapidly and jerkily pushed downwards (4...6 downwards movements per second).
The spray must then be well atomized.
The spray has an oval cross-section and is larger than the spray of a throttling pintle nozzle without surfaces at the pintle.



1 = Thermal-insulation ring 2 = Seal ring

22.4 Installing nozzle holder

On both engine types, a nozzle holder with an integral thermal-insulation ring is installed.

The thermal-insulation ring is positioned between the nozzle base and retaining nut (likewise with thermal-insulation function).

After every disassembly of the nozzle holder (opening-pressure adjustment or nozzle change), replace the thermal-insulation ring.

The seal ring is permanently attached to the recess of the nozzle retaining nut and must be replaced every time the nozzle holder is removed.

Press-in sleeve KDEP 1562 is used to press on the seal ring.

Installation instructions:

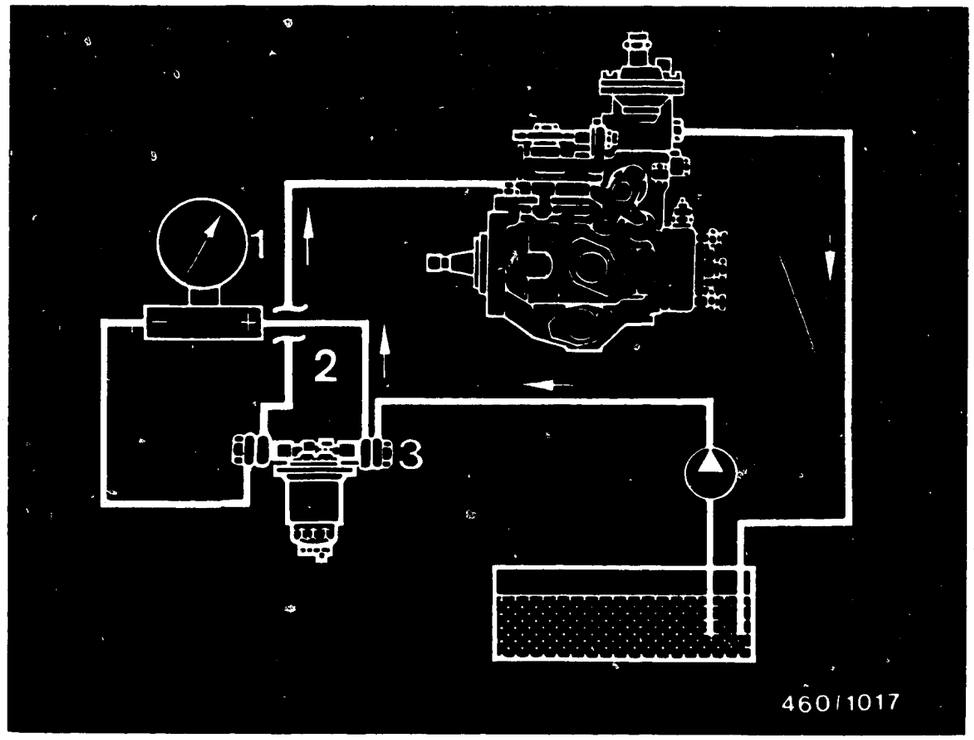
Position the seal ring so that the rounded side is towards the nozzle retaining nut.

Screw the nozzle holder into the cylinder head and tighten to 40...45 Nm.

Note:

If this tightening torque is exceeded, it can cause the nozzle needle to stick.

Tighten the union nut of the pressure lines to 20...25 Nm.



1 = Differential-pressure gauge
2 = Filter outlet (use inlet union and extra-long inlet-union screw 2 443 456 020)
3 = Filter inlet (use inlet union and extra-long inlet-union screw 2 443 456 020)

23. TESTING FUEL FILTER
(Differential-pressure test)

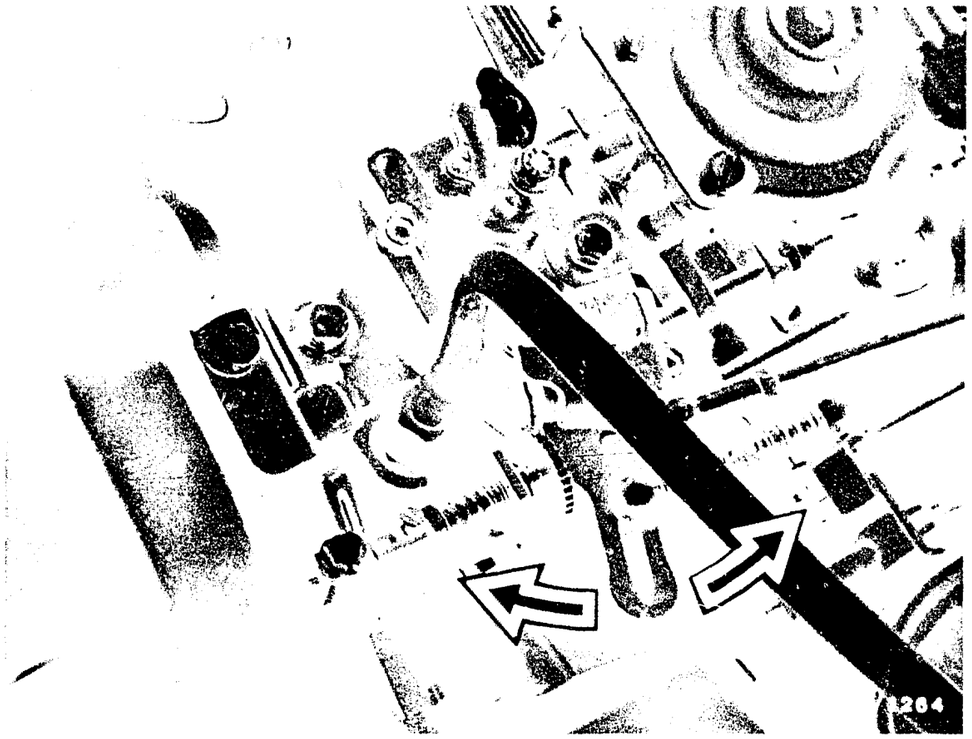
Connect the differential-pressure gauge to the fuel filter using the proper connection parts.

Connect the differential-pressure gauge to the fuel-filter inlet with the side marked (+).

Connect the (-) connection of the pressure gauge to the filter outlet.

Note the connection diagram.

Let the engine run until there is no chance of any air being in the fuel system.



Rapidly (approx. 1 second) move the control lever for the fuel-injection pump from the idle stop to the final engine-speed stop.

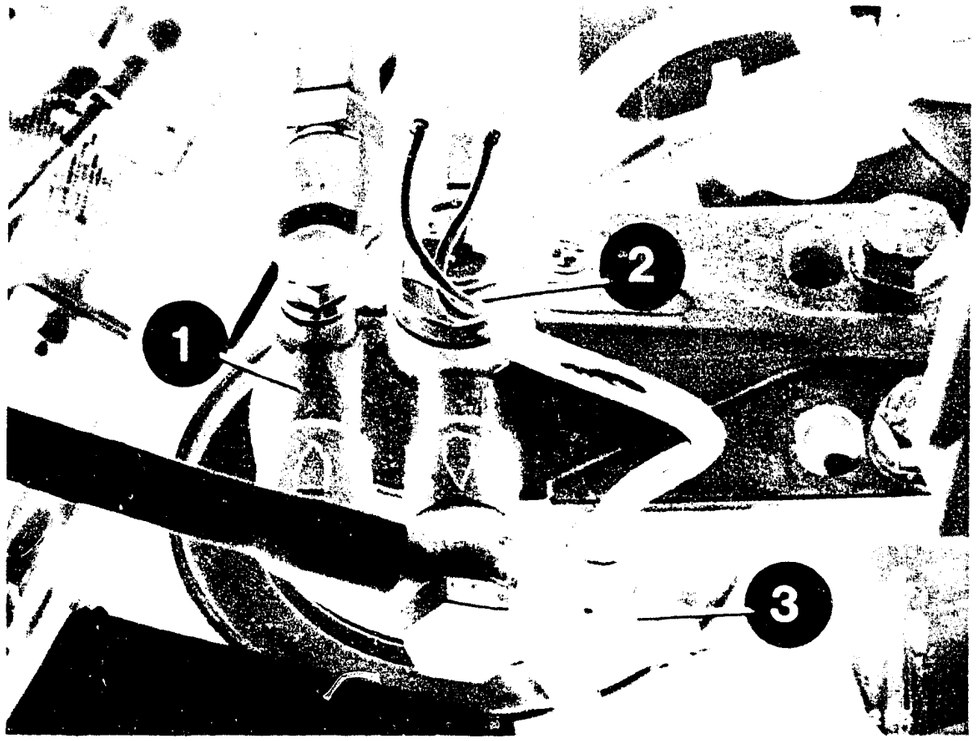
Release the control lever and read the differential pressure at the differential-pressure gauge.

The differential pressure may be maximum 0,3 bar.

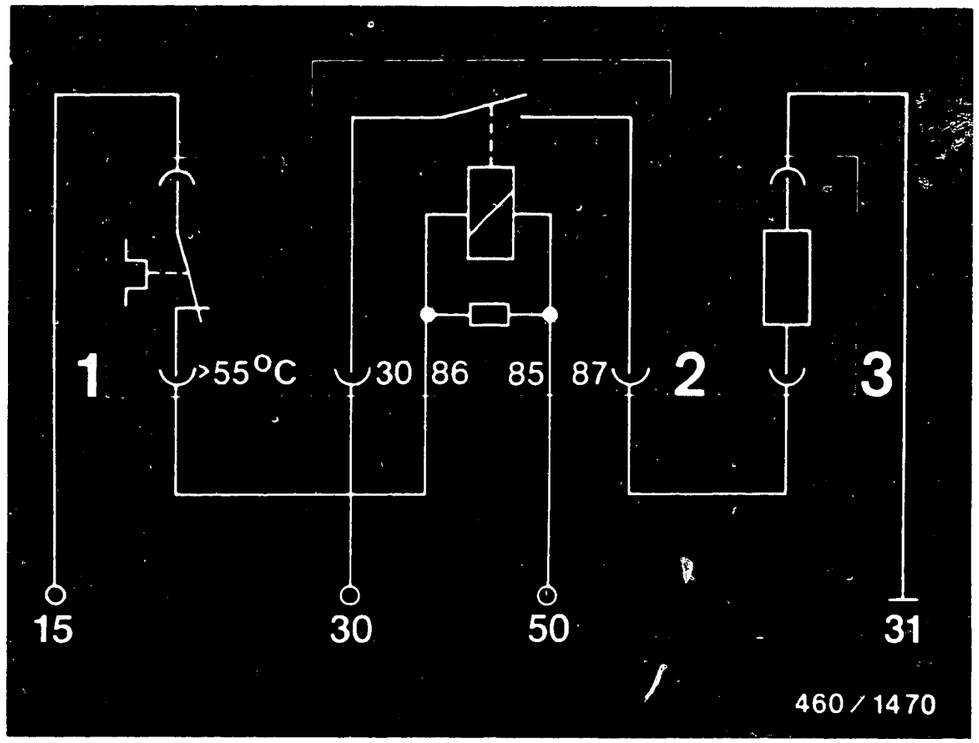
If this value is exceeded change the filter.

Remove test connections.

If necessary, bleed the fuel system.



1 = Heating element
2 = Temperature switch
3 = Heating-element connection



1 = Temperature switch 5.5°C
2 = Relay for fuel pre-heating
3 = Heating element

24. TESTING FUEL PRE-HEATING

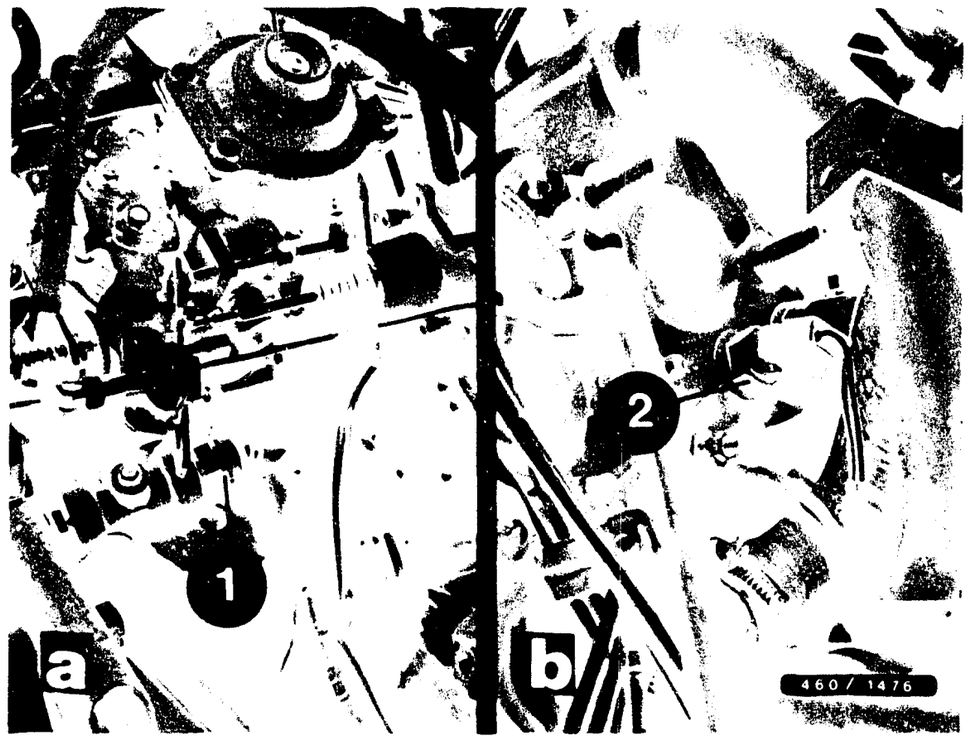
A heating element is installed in the cover of the fuel filter for pre-warming of the fuel.

At fuel temperatures below 5.5°C, a temperature switch installed in the filter cover automatically pre-warms the fuel.

Note:

Fuel pre-heating is switched off during starting.

Terminal diagram, fuel pre-heating



1 = KSB solenoid-operated valve
2 = Temperature sensor

25. TESTING COLD-START INJECTION ADVANCE

The KSB valve is supplied with voltage during the warm-up phase by a temperature switch.

Test instructions:

* With engine warm, bridge the temperature switch.
  Engine running will become noticeably rougher due to the earlier start of injection.

* Resistance of the KSB solenoid-operated valve at 20°C is 3,5 ... 5,5 Ω .

26. TESTING GLOW-PLUG PREHEATING SYSTEM

Required test equipment

Preheating tester e.g. ETT 011.00
Part no. 0 684 101 100

Workshop instructions

We recommend replacing the sheathed-element glow plugs every 45,000 km (28,000 miles).

Note:
If start of delivery is incorrectly set, the service life of the glow plugs may be considerably reduced.

Preheating times

The switch-on duration of the preheating system depends on the coolant temperature.

Check preheating system

V

Requirements for testing:

* Battery OK?
* Compression OK? If necessary, check compression drop.
  Are fuel supply and injection system OK?

Y

V

Testing voltage supply of sheathed-element glow plugs

N>

Connect voltmeter between glow plugs and ground, one after the other. Bring glow-plug and starter switch to position 1 (yellow indicator lamp lights up). The pre-heating procedure is initiated. The voltmeter should show at lease 10 V.

N o t e :
After a minimum of 8...13 seconds, the system automatically switches off. If measurement needs to be repeated, the glow-plug and starter switch first should be returned to position 1.

Is the minimum voltage present at all glow plugs?

Y

V

Continued on next picture page

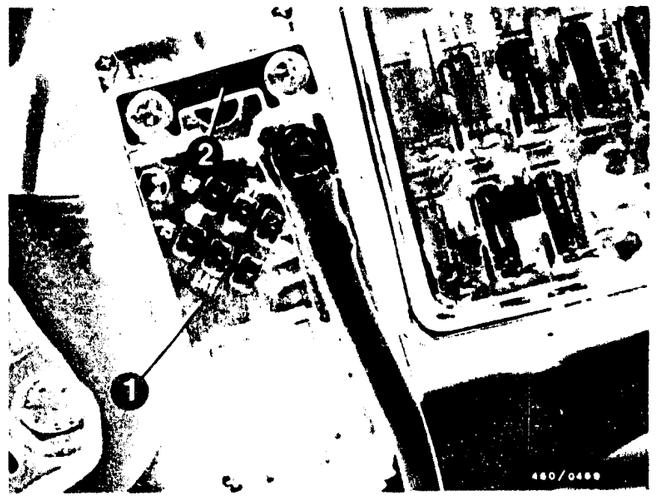
* Check leads from glow-duration unit terms. 1...6 to the sheathed-element glow plugs for open circuits.
  Eliminate any open circuits.

* Check lead from battery (+) to glow-duration unit for open circuits. Eliminate any open circuits.

* Check ground lead from glow-duration unit term. 31 for open circuits. If any are found, eliminate.

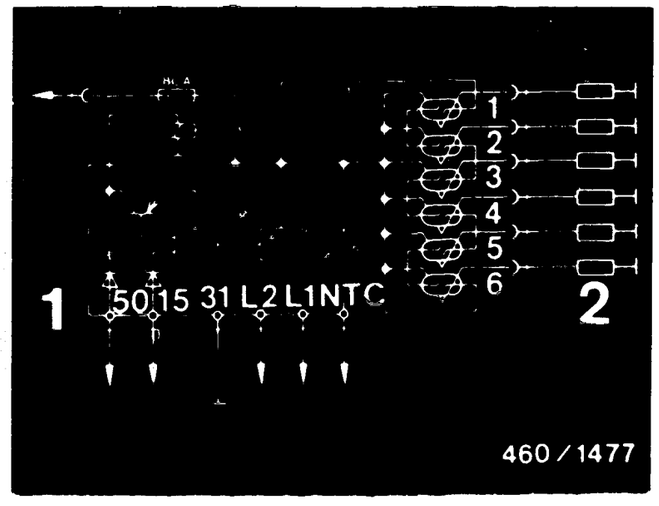
* Remove the protective cap from the glow-duration unit and check and if necessary replace the fuse strip (80 A).

If points 1...4 are OK, replace the glow-duration unit.



1 = Glow-duration unit
2 = Fuse strip (80 A)

1 = Glow-duration unit
2 = Sheathed-element glow plugs



Check preheating system (continued 1)

Testing starting indicator lamps
(upper illustration)

Move glow-plug and starter switch to position 1.

Starting control lamp L1 (yellow) should light up.

Shortly thereafter, L1 (yellow) goes out and L2 (green) should light up.

Do both starting indicator lamps light up in the correct sequence?

N>

Green indicator lamp L2 does not light up
(middle illustration)

Check sheathed-element glow plug (G) for open circuit.

Replace defective glow plug(s).

Both indicator lamps fail to light up
(lower illustration)

1. Check leads from glow-duration unit to starting indicator lamps L1 and L2, including the starting indicator lamps, as well as their ground connection, for open circuits.

2. Remove the protective cap from the glow-duration unit and check and if necessary replace strip fuse (80 A).

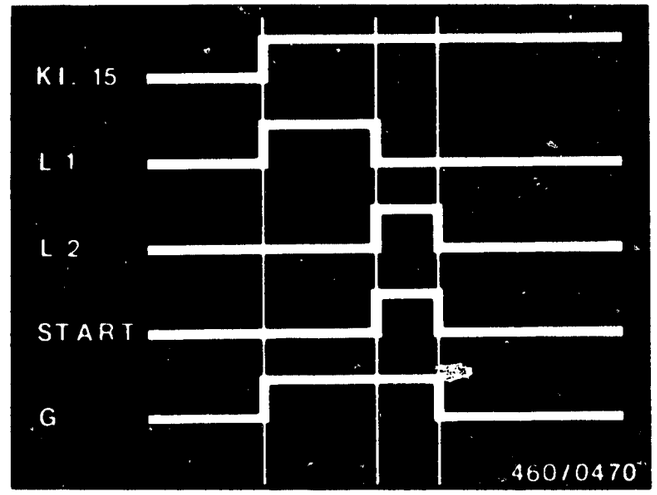
If points 1 and 2 are OK, replace the glow-duration unit.

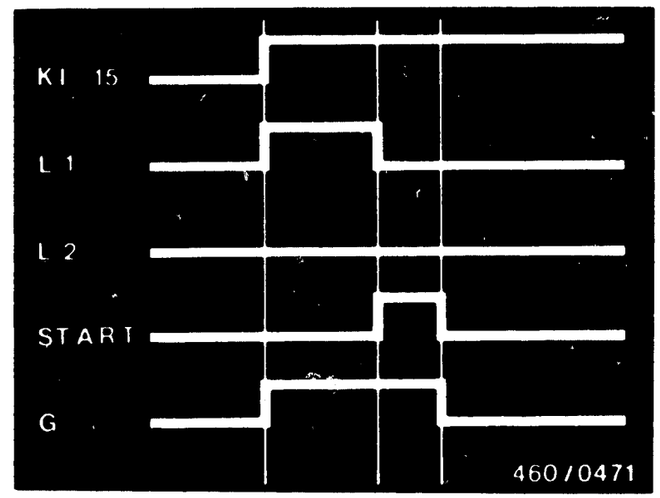
Y

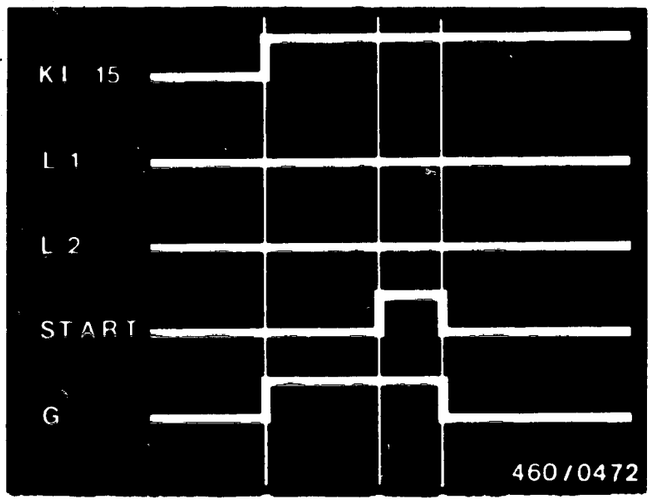
Continued on next picture page

Y

Continued on next picture page







Check preheating system (continued 2)

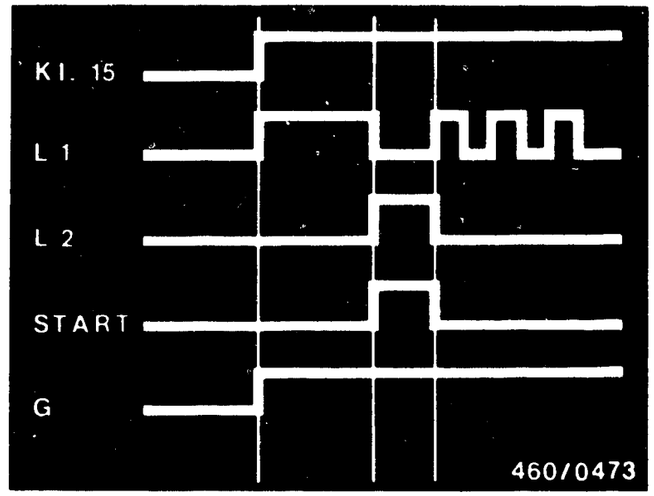
V

Yellow indicator lamp L1 blinks
(upper illustration)

A blinking indicator lamp indicates that the sheathed-element glow plugs are still glowing after starting. Disconnect the plug connection for the glow-duration unit and replace the unit.

Remark:
If the yellow indicator lamp L1 does not light up, but if readiness for starting (green lamp L2) is nevertheless indicated after preheating, it may be that the yellow lamp is defective.

Replace glow-duration unit.



V

Testing safety shutoff

N>

Connect voltmeter between a glow plug and ground.
Move glow-plug and starter switch to position "1" (yellow indicator lamp lights up).

Preheating is initiated. After a certain preheating duration, depending on the ambient temperature, L2 (green) lights up.

The voltmeter should show voltage for 13 seconds (lower illustration).

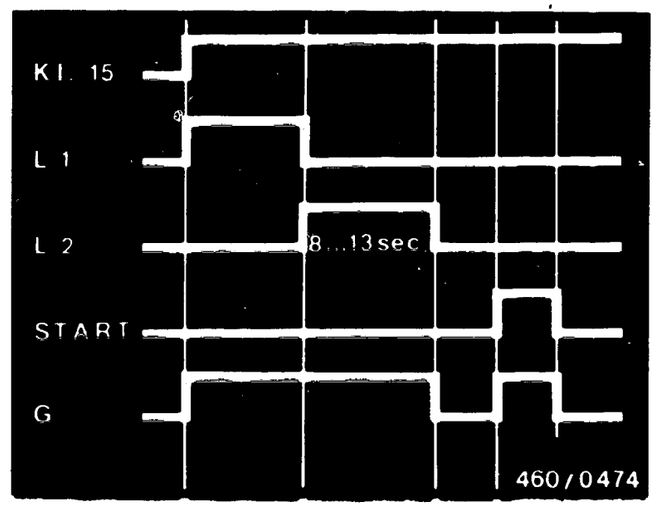
After the prescribed time has elapsed, the voltmeter must show 0 V.

Does voltmeter show 0 V after the prescribed time?

V

V

Continued on next picture page



Check preheating system (continued 3)

V

Checking glowing upon starter actuation:

Connect voltmeter between a glow plug and ground.

Move glow-plug and starter switch to position "2" (start).

The voltmeter should show a voltage of 10 V.

Is there voltage?

N>

1. Check lead from glow-plug and starter switch term. 50 to glow-duration unit term. 50 for open circuits.

   Eliminate open circuits.

2. If point 1 is OK, replace the glow-duration unit.

Y

V

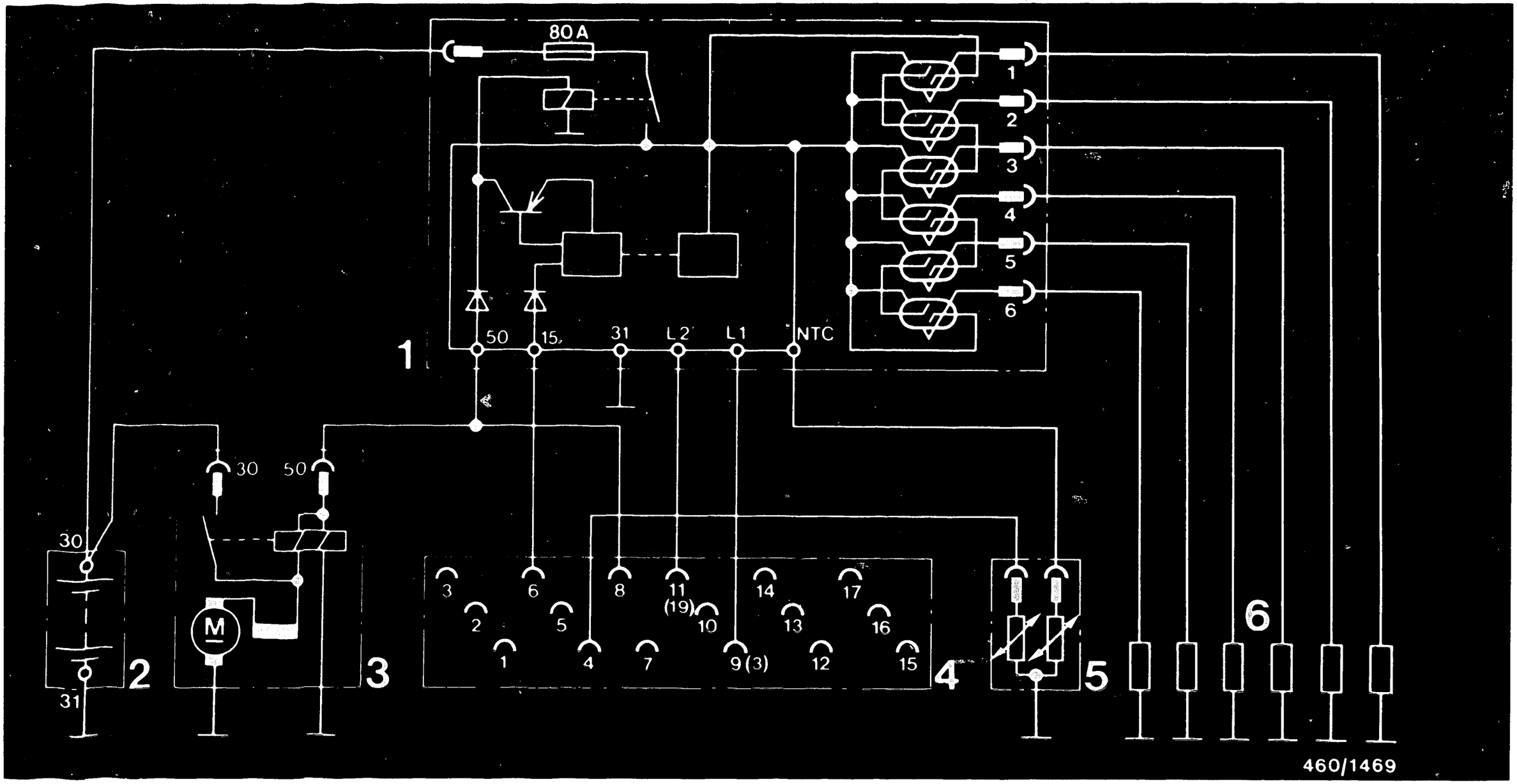
Test sheathed-element glow plugs.

Individually check glow plugs for continuity using ohmmeter.

Does glow plug show continuity?

N>

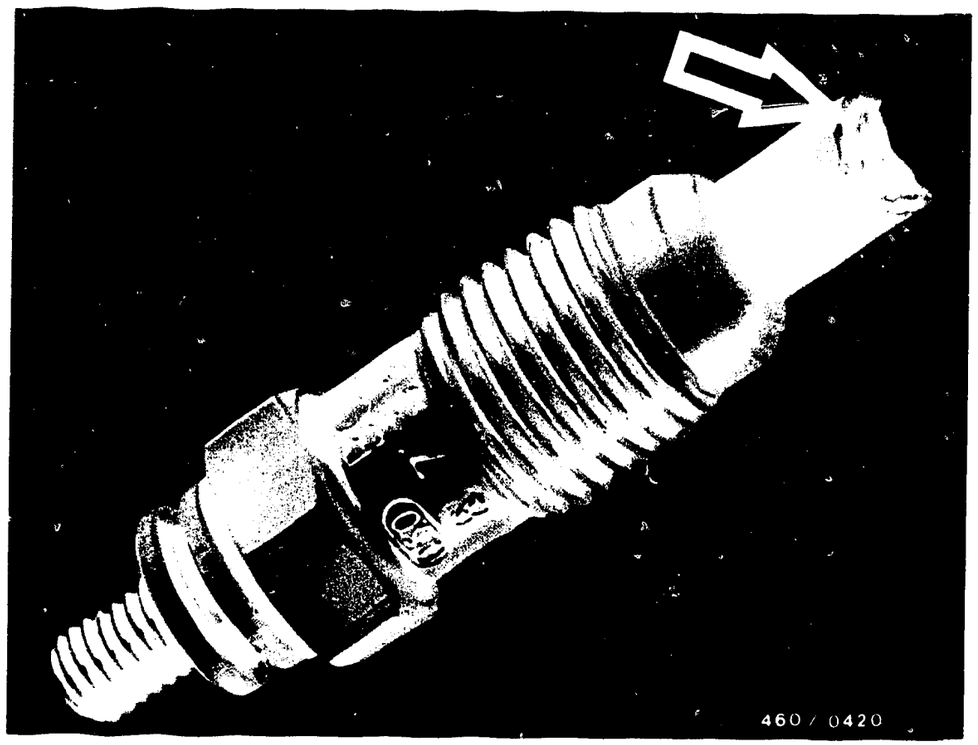
Replace sheathed-element glow plug(s).



1 = Glow-duration unit
2 = Battery
3 = Starter
4 = Diagnostic plug
5 = Temperature sensor
6 = Sheathed-element glow plugs

Note: () = 324d

26.1 Circuit diagram, preheating system



Note:

Glow plugs with burnt glow elements

Glow plugs with burnt glo·· elements are often the result of nozzle problems.

If in case of a customer complaint such glow plugs are found (arrow), it is not sufficient merely to replace these plugs.
It is also necessary to test the injection nozzles for spray shape, chatter, pressure, and leakage.

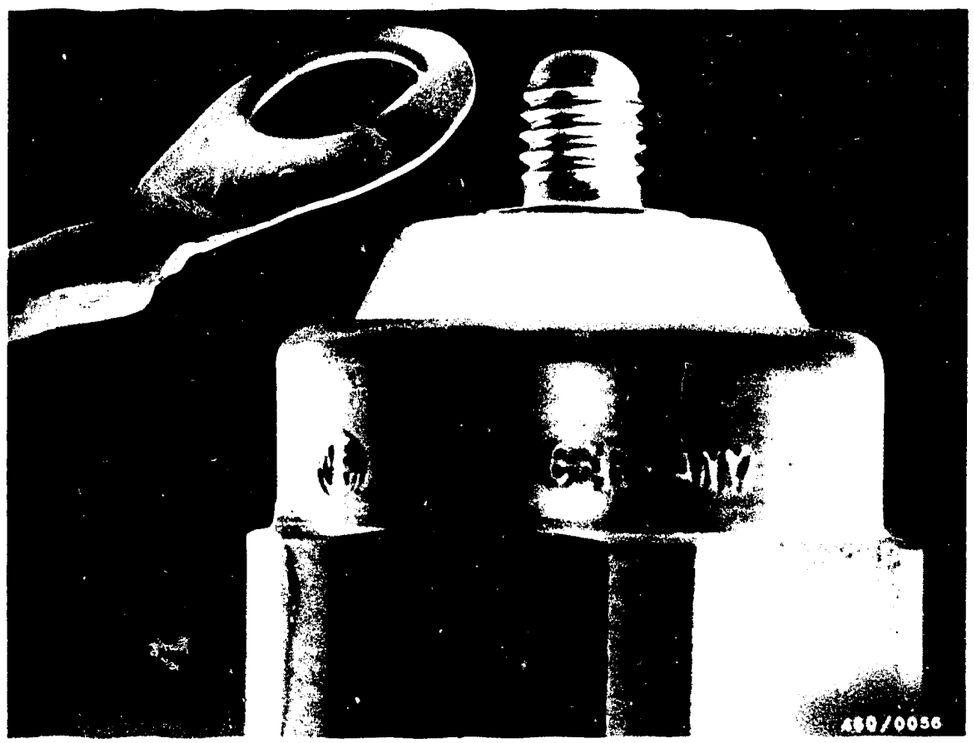
27. TESTING TIMING DEVICE

(Remove fuel-injection pump)

With distributor-type fuel-injection pumps VE..F.., the timing device is integrated in the injection pump.

In order to test the timing device, the fuel-injection pump must be removed.

Testing is carried out on the fuel-injection pump test bench.



28. MEASURING ENGINE COMPRESSION AND PRESSURE LOSS

28.1 Measuring engine compression

Requirements for testing:
* Coolant temperature max. + 35°C
* Disconnect plug connection at preheating control unit (danger of short circuit)
* Battery in proper charged condition.

The compression tracer must be provided with a new graph page.

Fasten the high-pressure hose to the tracer.

Switch off engine.

In order to prevent fuel from being injected, remove the connecting cable at the shutoff solenoid of the distributor-type fuel-injection pump (illustration).

Unscrew sheathed-element glow plugs and make the engine turn over several times with the help of the starter, so that loose residues are removed from the compression area.

Insert compression tester into the tapped hole of the glow plugs with

connecting nipple, part no. 6 220 103 236 and
angle piece part no. 6 220 103 163.

During the following step, observe the first compression stroke.

Actuate starter until no more pressure rise can be located on the compression tracer.

Ventilate the compression tracer by means of pressure on the bleeder valve.

The indicator will go back to its original position.

Bring the graph page into the next position.

Fasten the connecting nipple to the following cylinders and repeat measurement:

Compression:	approx. 24 bar
At least:	20 bar

28.1.1 Assessment of the graph page

1. Normal compression increase

If the piston rings and valves are in good shape, the first compression stroke will show the highest pressure increase.

During subsequent compression strokes, the compression will build up to maximum.

2. Compression increase in stages

If the compression increases only step-by-step per piston stroke from the beginning, this indicates burned valve seats or inadequate valve guiding.

3. Low maximum compression

If the maximum compression reached is too low in all cylinders, this indicates defective pistons, piston rings, or valves.

Excessively low compression at two neighboring cylinders is an indication of poor cylinder-head sealing.

4. Differing compression

If a cylinder shows significantly low compression, proceed as follows:

Add 2...3 cm ^{3} engine oil through the opening of the glow plug or the nozzle holder, and briefly actuate the starter.

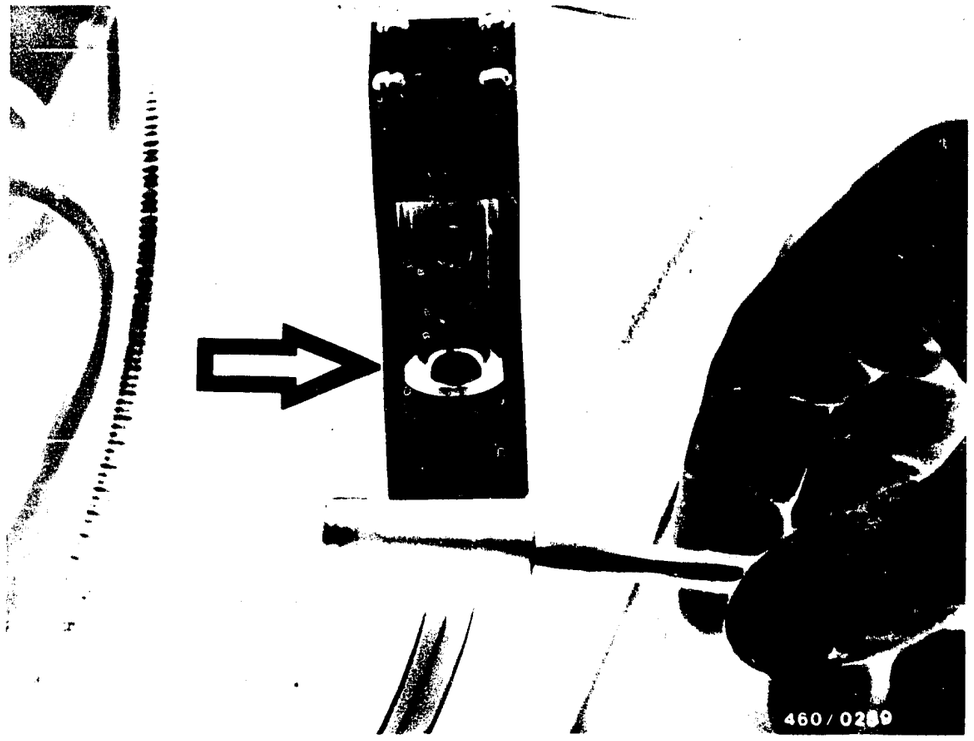
Repeat testing and compare graph pages.
If the compression of the second test is significantly higher, there is wear in the piston rings or the cylinder.

If the new result is no different, defective valves are the problem.

5. Even compression

Even compression is very important for smooth engine running.

For this reason, the highest possible compression is not the only objective.



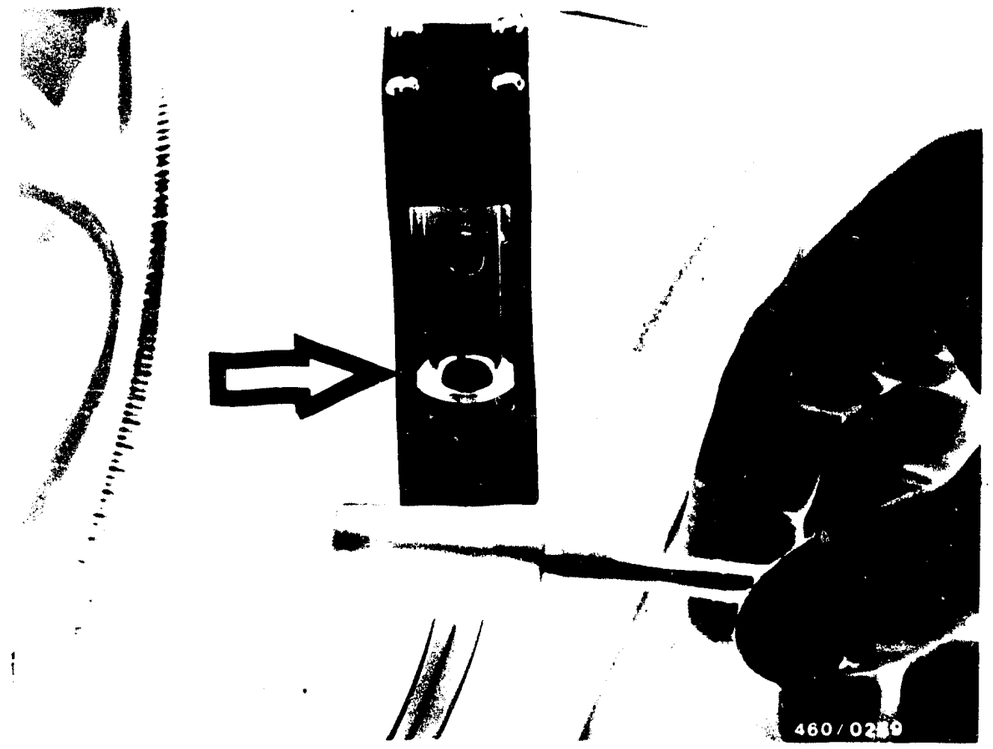
28.2 Measuring engine compression loss

The BOSCH compression-loss tester 0 681 001 901 (EFAW 210 A) is used for this testing.

The cylinder concerned must be in the TDC position (TDC = top dead center) of the compression stroke for testing.

To set this point, use the dead-center finder 1 688 132 025 (included among the accessories of the compression-loss tester).

Testing is carried out with the engine at normal operating temperature (coolant temperature approx. 80°C).



28.2.1 Setting top dead center

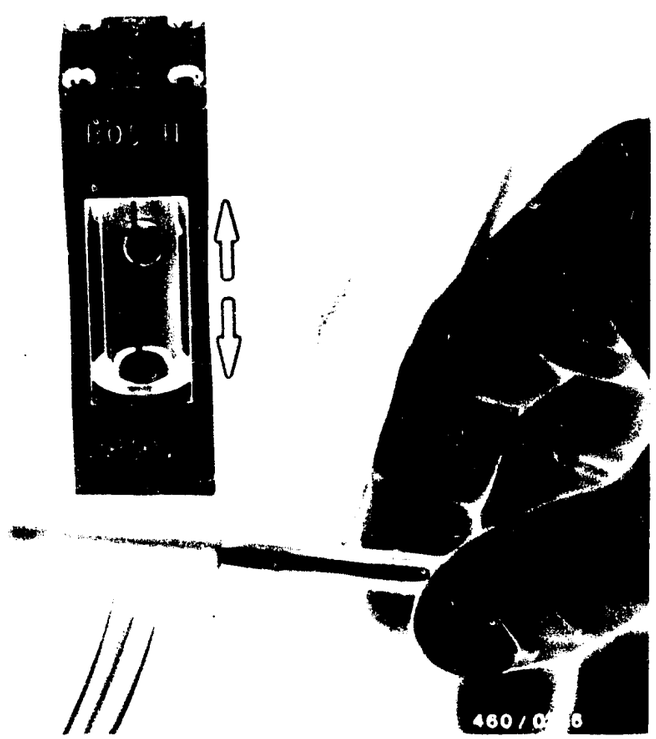
Remove the sheathed-element glow plugs from the 1rst cylinder.

Insert the rubber plugs of the dead-center finder into the glow-plug holes.

Fasten the glass cylinder with magnet as vertically as possible in the engine compartment.

The plunger of the tester must be easily visible.

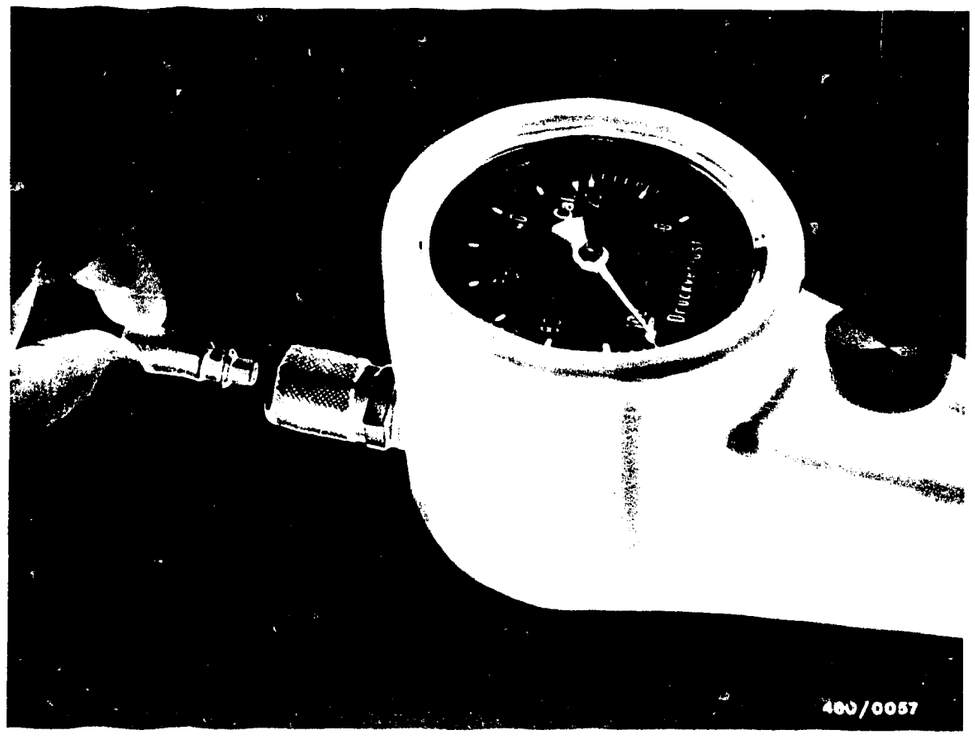
Slowly turn the engine by hand in the direction of engine rotation (if necessary, put vehicle in gear and push).



In the compression stroke, the plunger of the dead-center finder will be pushed upwards.

As top dead center is exceeded, the piston will immediately slide downwards.

Find top dead center by carefully turning the engine back and forth.



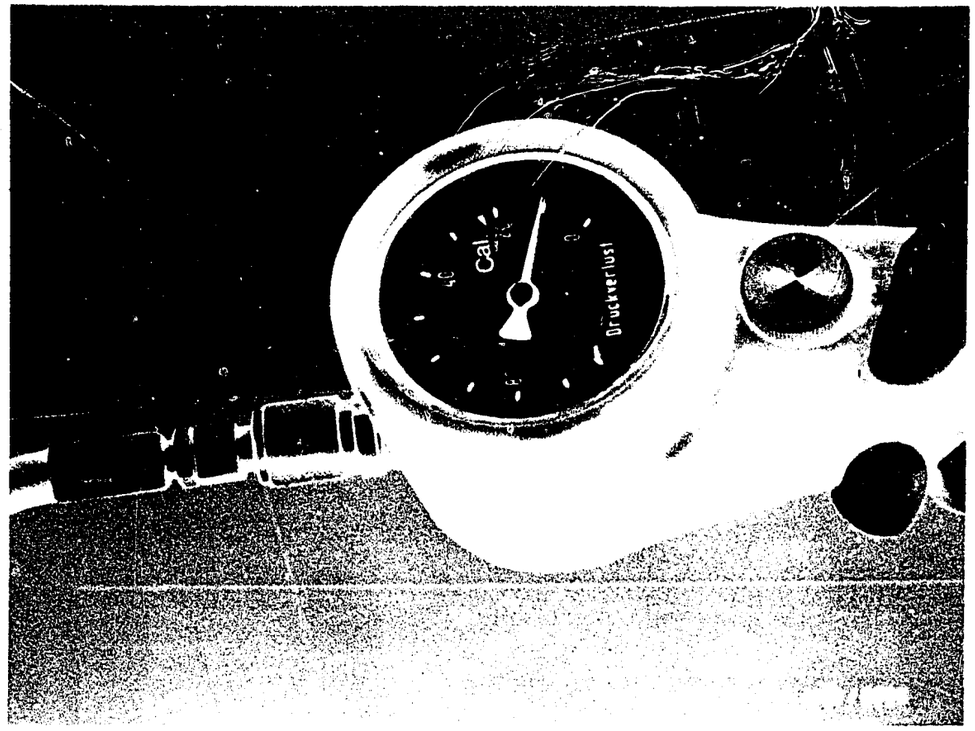
28.2.2 Measuring compression loss

Connect the tester to the compressed-air system already present.

Connect test nozzle 1 680 363 036.

Set a compression loss of 23 ± 1% ("Cal." marking) at the knurled-head screw of the pressure-regulation valve.

The indicator of the measuring instrument may deviate by up to one graduation mark from the plus/minus zero point. Otherwise, the tester is defective.



Screw in connection fitting and connect test hose.

Engage gear and parking brake.

Connect test hose to tester.

Read compression loss in % at the instrument.

Note:

Before measuring at the next cylinder, actuate the engine with the starter briefly without pre-heating, in order to form a new oil film.

28.2.3 Evaluating the test

The indicated compression loss should not exceed 25%.

Differences of 10% between the individual cylinders are insignificant.

Serious leakage can be located, as the air will be audible as it flows out.

Listen at the following points:

Noise points	Possible source of fault
Intake manifold (remove air filter)	Inlet valve
Exhaust manifold	Discharge valve
Engine oil filler inlets	Pistons, piston rings
Coolant inlet connection (air bubbles)	Cylinder-head sealing

In order to be able to locate the source of trouble still better, pour 2...3 cm^3 engine oil into the cylinders.

Repeat testing.

If compression loss is significantly reduced during this repeat testing, the source of the problem is the piston or the piston rings.

With new engines that have not yet been broken in (less than 5,000 km/3,000 miles), there may be higher compression losses than after the break-in period.

29. REMOVING FUEL-INJECTION PUMP

Remove engine-compartment protection from below engine (324d).

Disconnect battery negative.

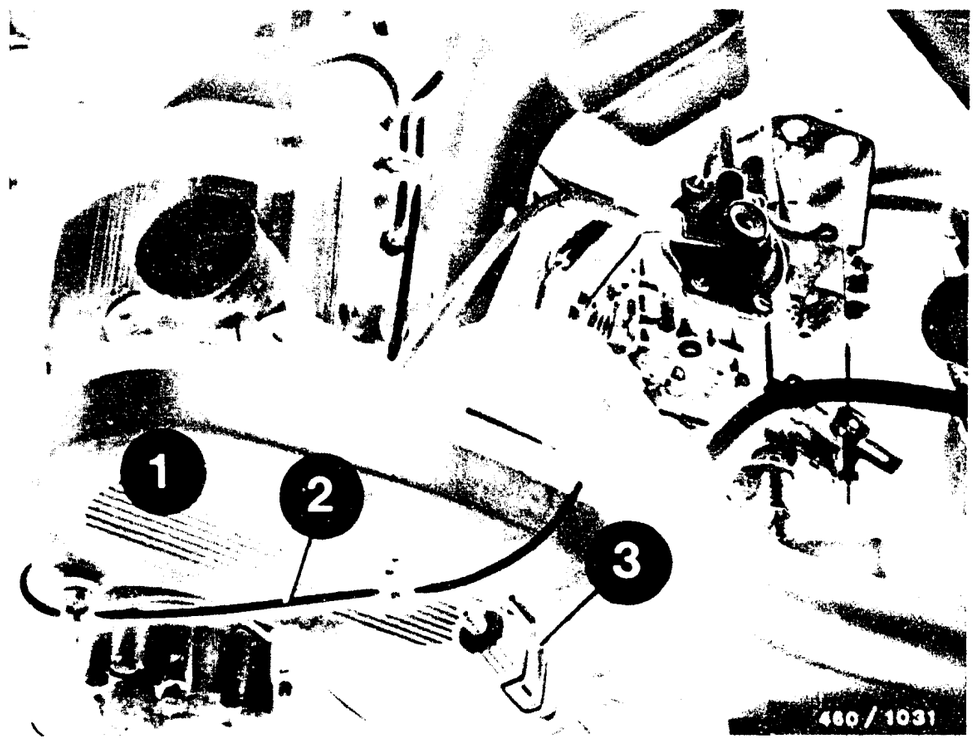
Turn crankshaft until the TDC marking (cylinder 1) on the belt pulley is flush with the reference mark (arrow).

The piston of the 1rst cylinder is now at TDC (valves of cylinder 6 at overlap).

1 = Hose clamp

2 = V-belt

Remove the coolant-hose clamp and V-belt from the generator.



1 = Toothed-belt cover
2 = Wiring harness
3 = Pinching clamp

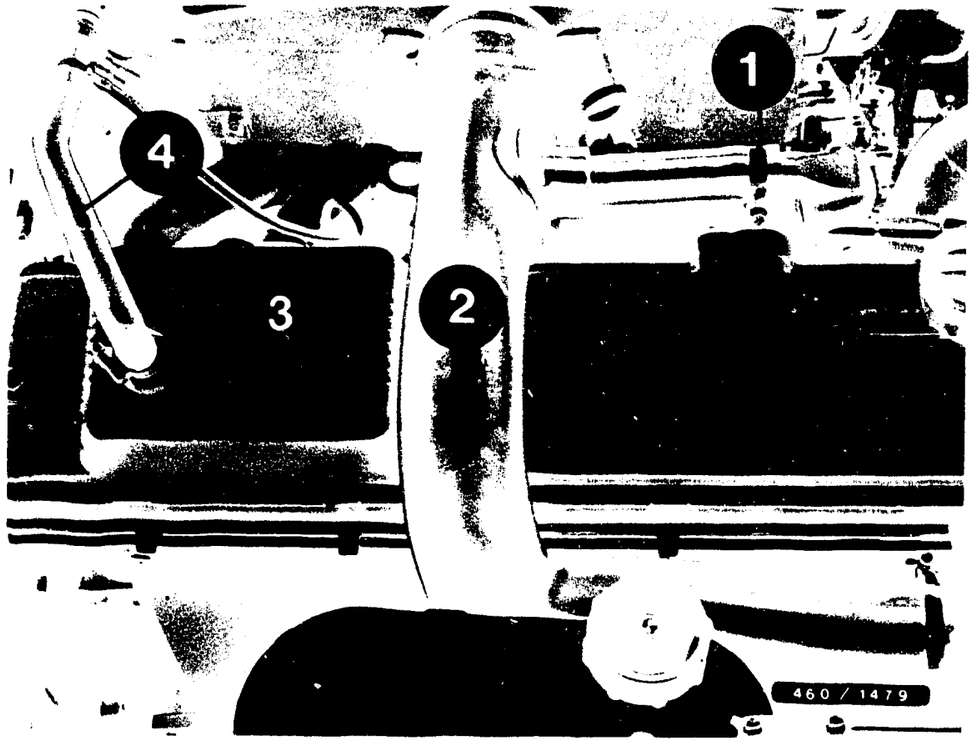
Removing wiring harness (but not on 324d).

Briefly pinch off the coolant hose downline from the water pump with a commercially-available clamp.

Loosen hose clips and pull off coolant hose.

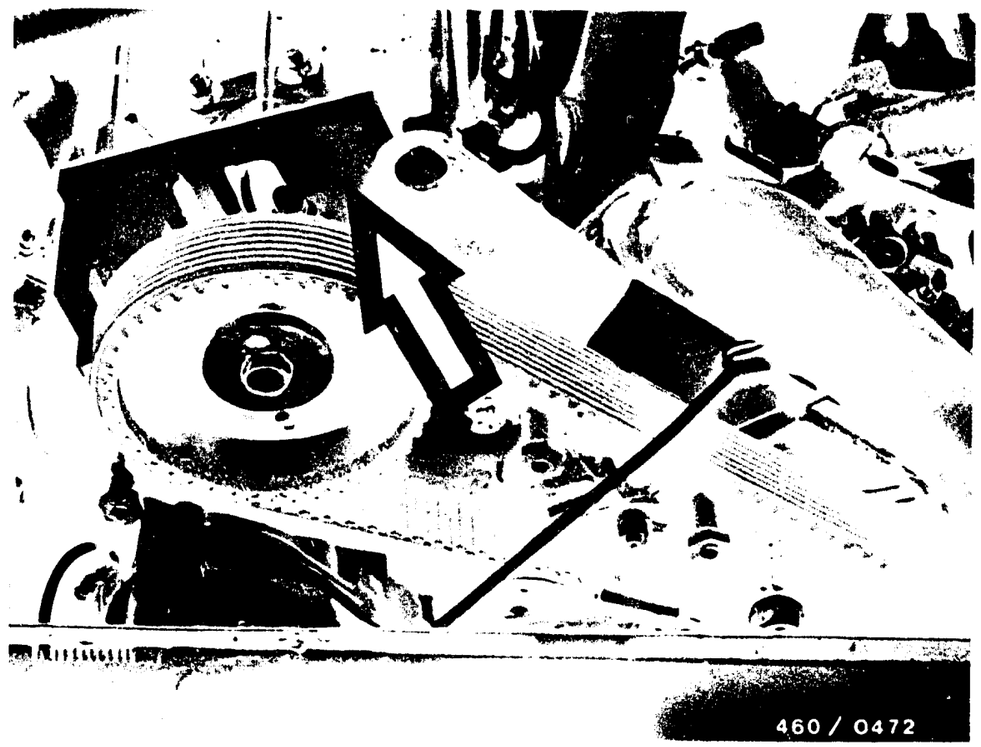
Catch coolant.

Remove toothed-belt cover.



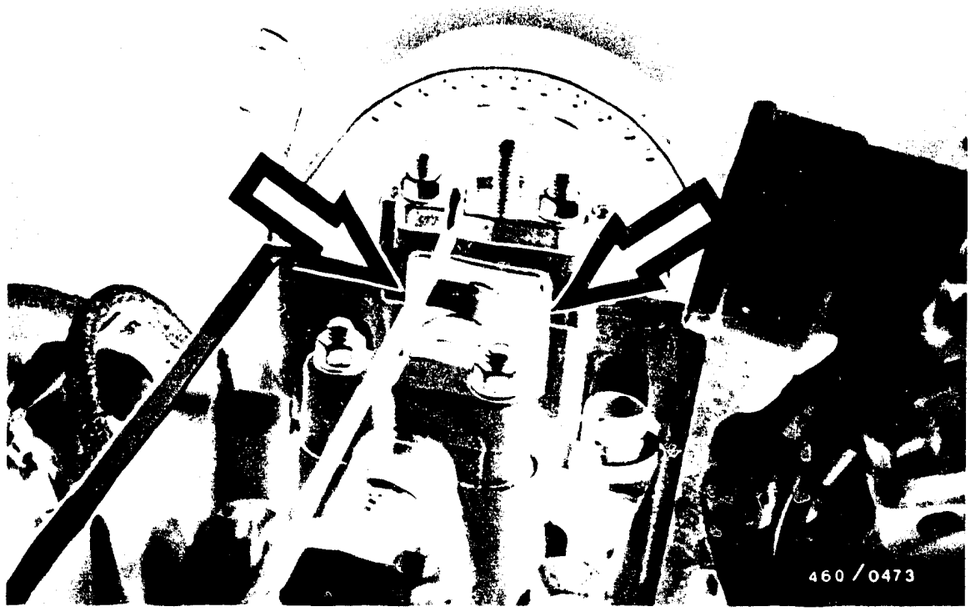
1 = Crankcase ventilation
2 = Connecting hose
3 = Cylinder-head cover
4 = Vacuum hose

Remove the crankcase ventilation, connecting hose between turbo-supercharger/air filter and collecting manifold, vacuum hose, and cylinder-head cover.



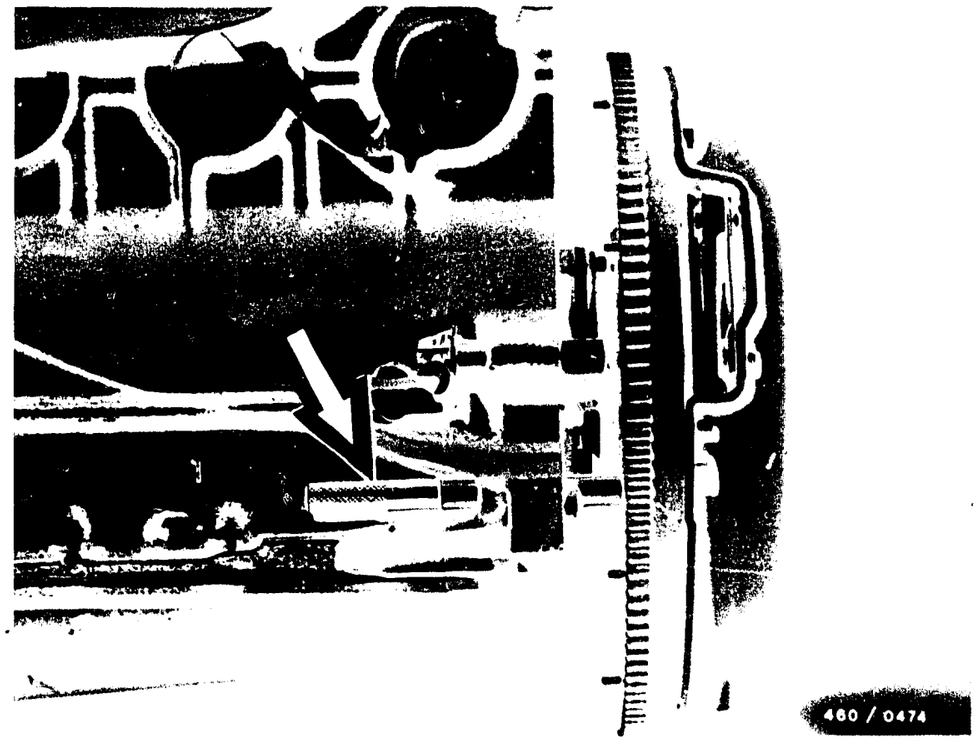
Fix camshaft in position with stop device KDEP 1136 (arrow).

Valves of the 6th cylinder are in the overlap position.



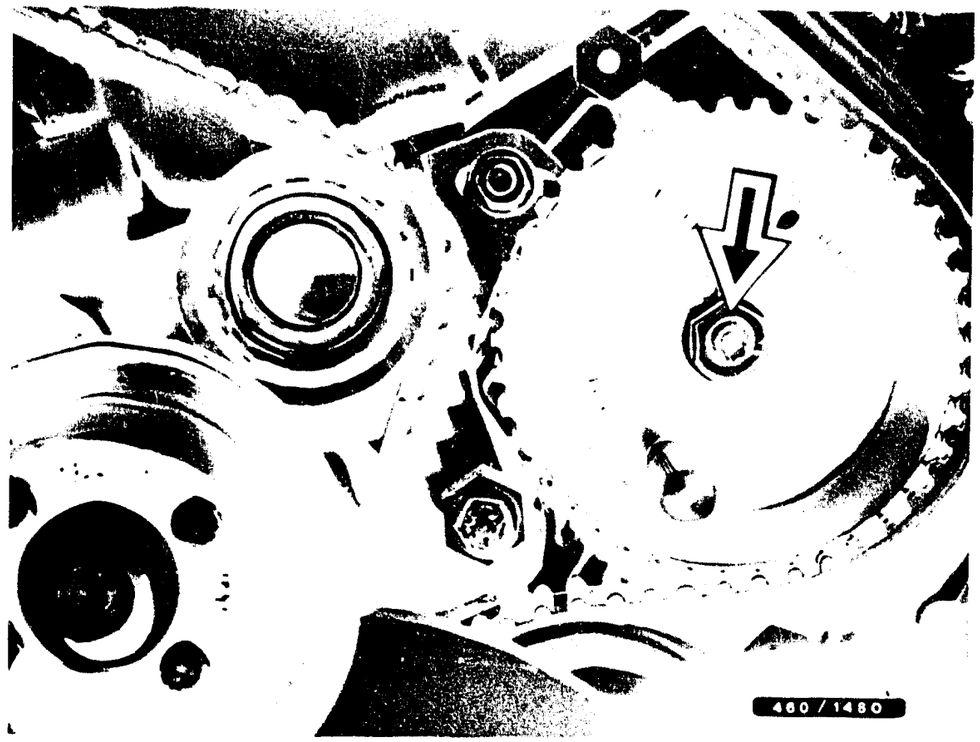
Note:

The stop device fits only over the two worked surfaces of the square (arrows).

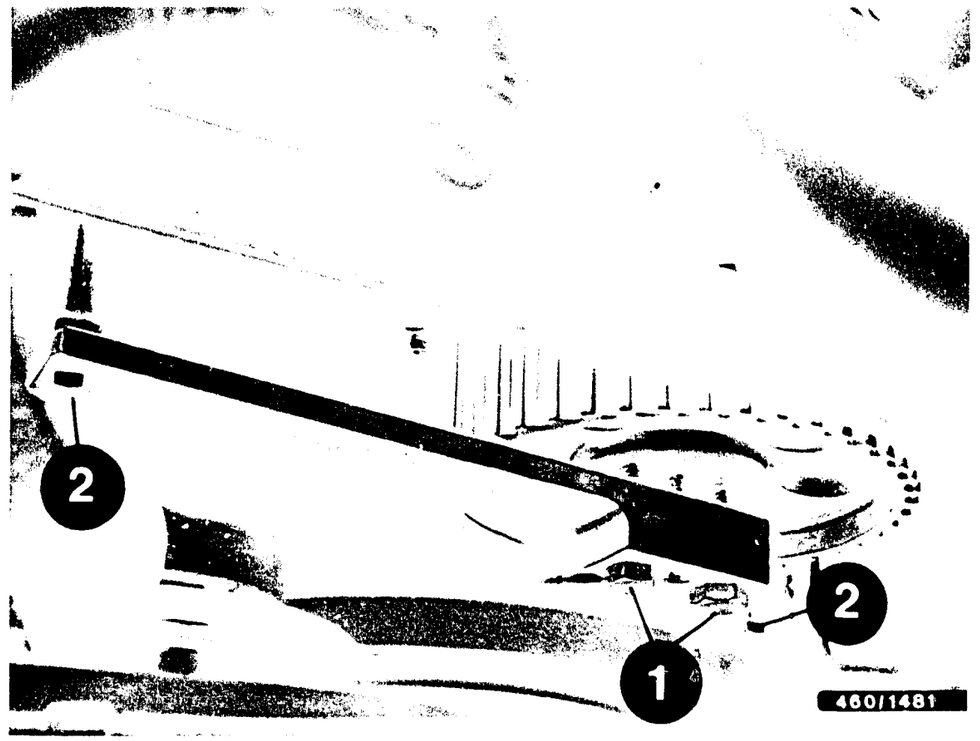


Arrest flywheel with setting mandrel KDEP 1139 (arrow).

If the setting mandrel cannot be guided in, correct the engine timing.



Arrest the injection-pump gear with setting mandrel KDEP 1138, unscrew the fastening nut (arrow), and remove setting mandrel.

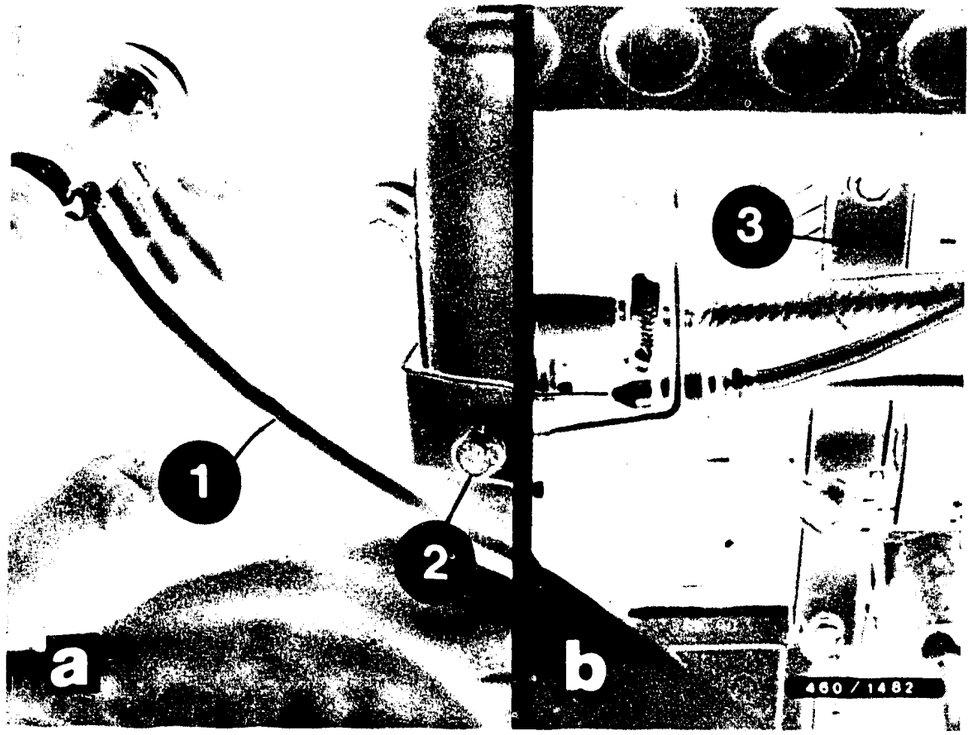


Arrest the injection-pump gear with holding and pressing device KDEP 1156.

To do this, screw fastening screws (1) into injection-pump gear and screws (2) into fastening bolts of the toothed-belt protective hood.

Note:

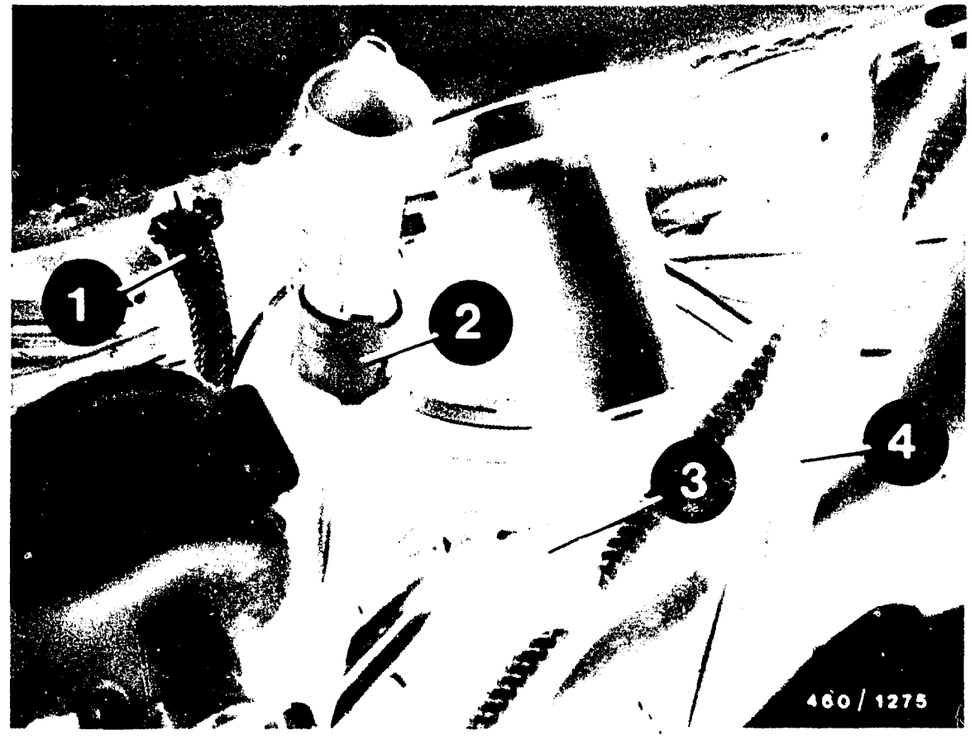
If the screw (2) cannot be tightened, remove the setting device and change the position of the gear.



1 = Vacuum hose
2 = Cable clamp
3 = Bracket

324d

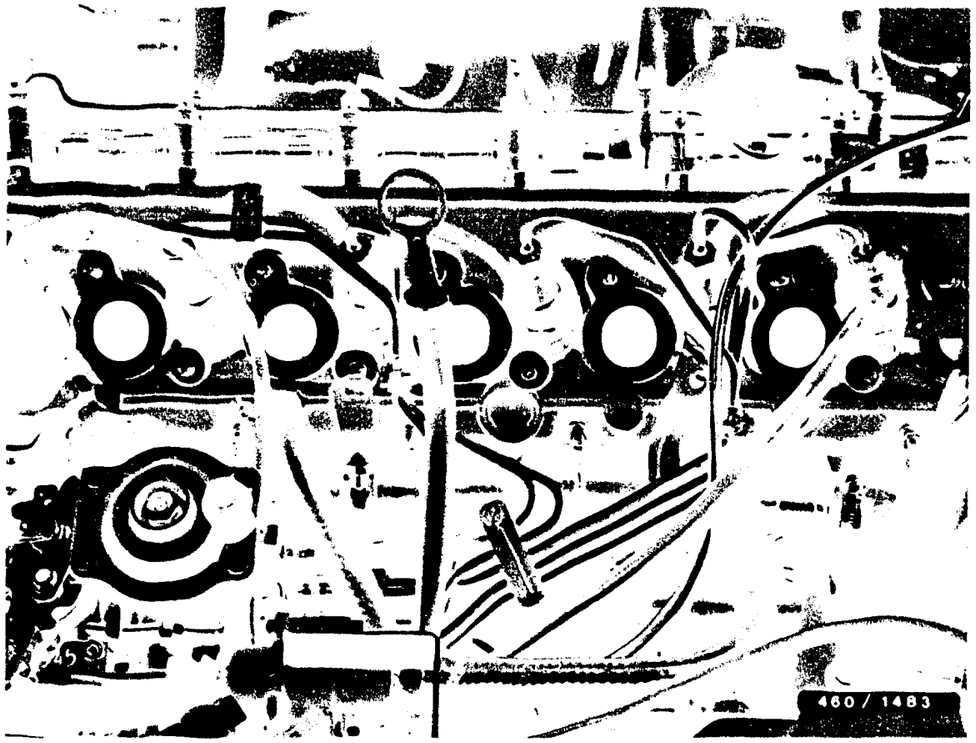
Remove vacuum hose, cable clamp, and bracket on collecting manifold.



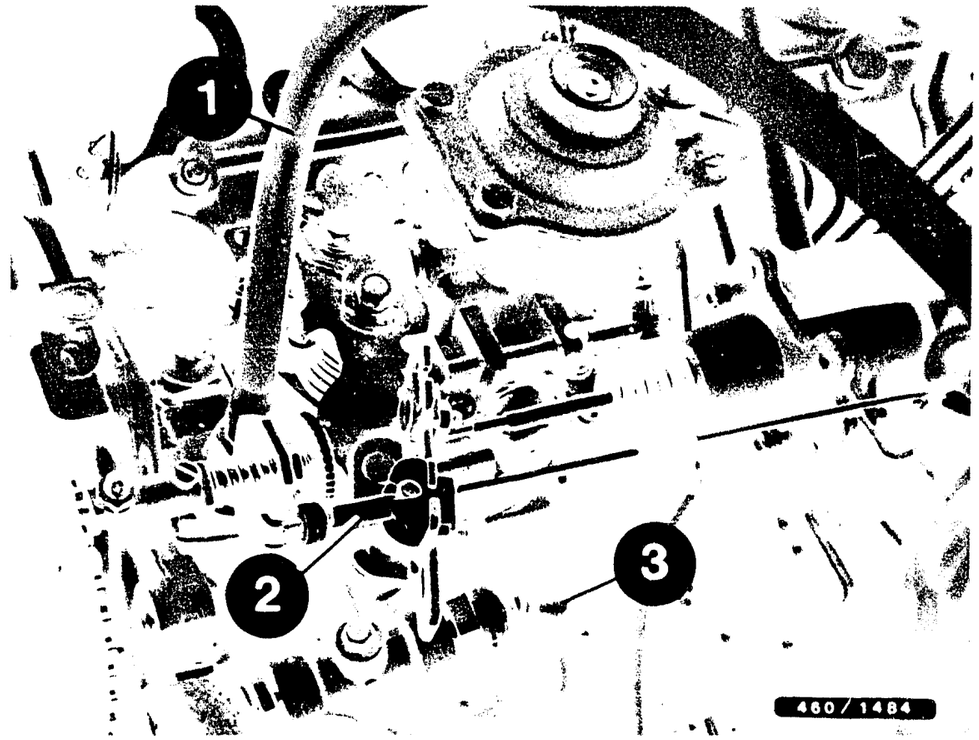
1 = Hose line
2 = Clamp
3 = Plug connection
4 = Support

524td

Remove hose line to LDA, fastening clamp for dipstick, plug connection at blow-off valve, and support for charge-air pipe.



Remove collecting manifold.

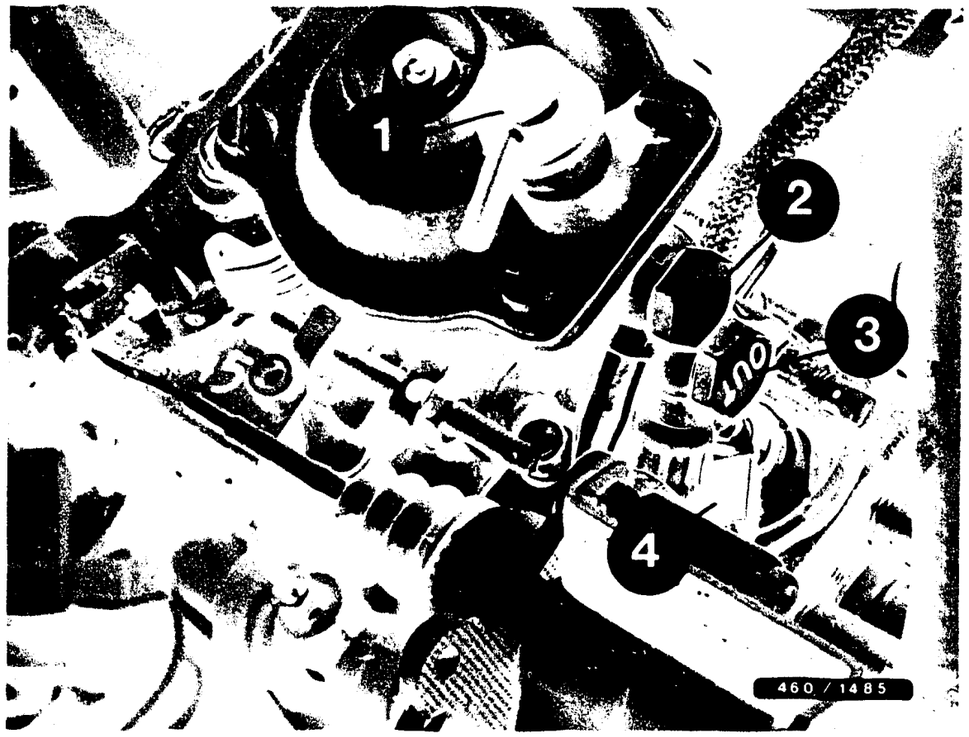


1 = Fuel supply line
2 = Bowden cable (accelerator pedal)
3 = Electric lead

Unscrew fuel supply line at fuel filter.

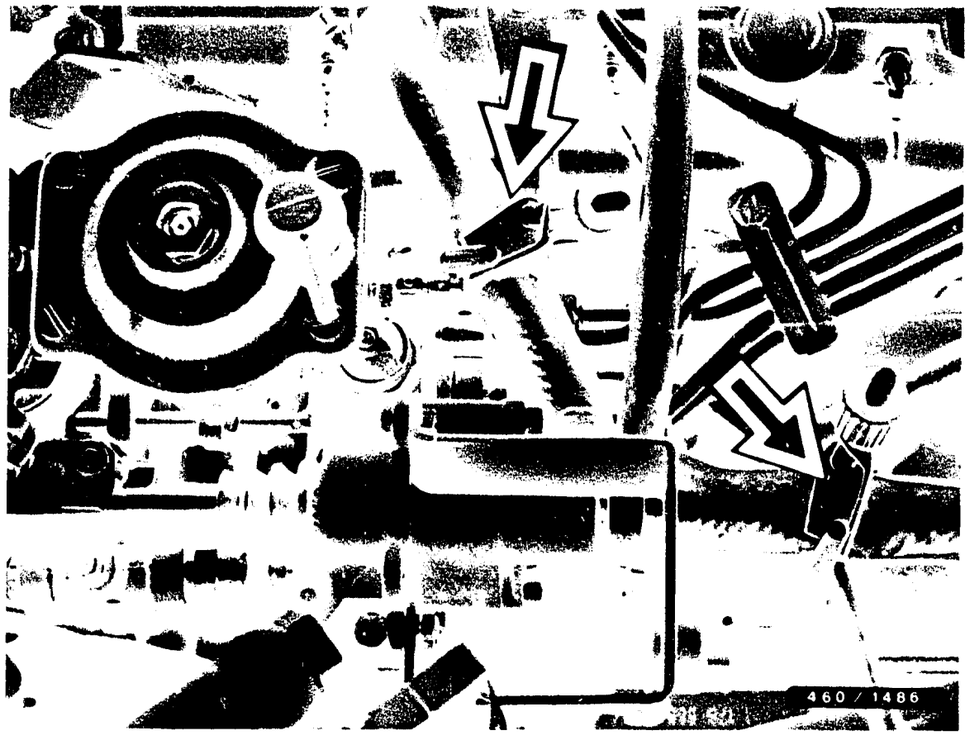
Disengage bowden cable at control lever.

Pull electric lead at KSB solenoid-operated valve.



1 = Charge-air pressure connection
2 = Vacuum connection
3 = Fuel return line
4 = Electrical lead

Remove fuel return line, electric lead at shutoff solenoid, and vacuum connection (324d) or charge-air pressure connection (524td).



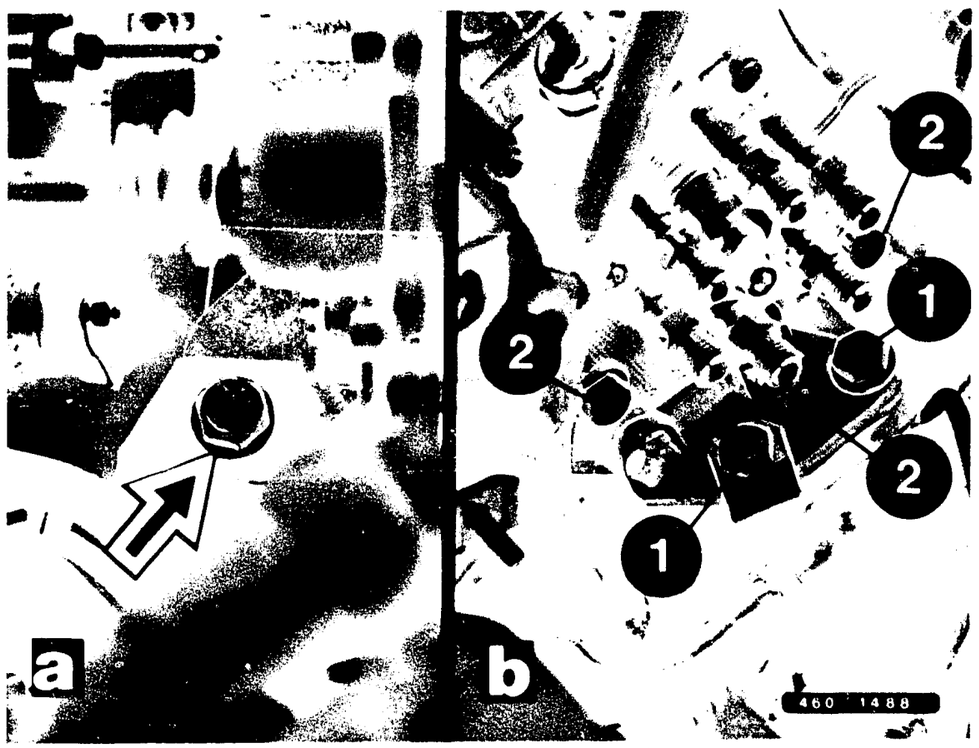
Pinch off coolant hoses with commercially-available spring clips (arrows).

Loosen hose clamps and pull off coolant hoses.

Remove injection tubing at delivery-valve and nozzle holders.

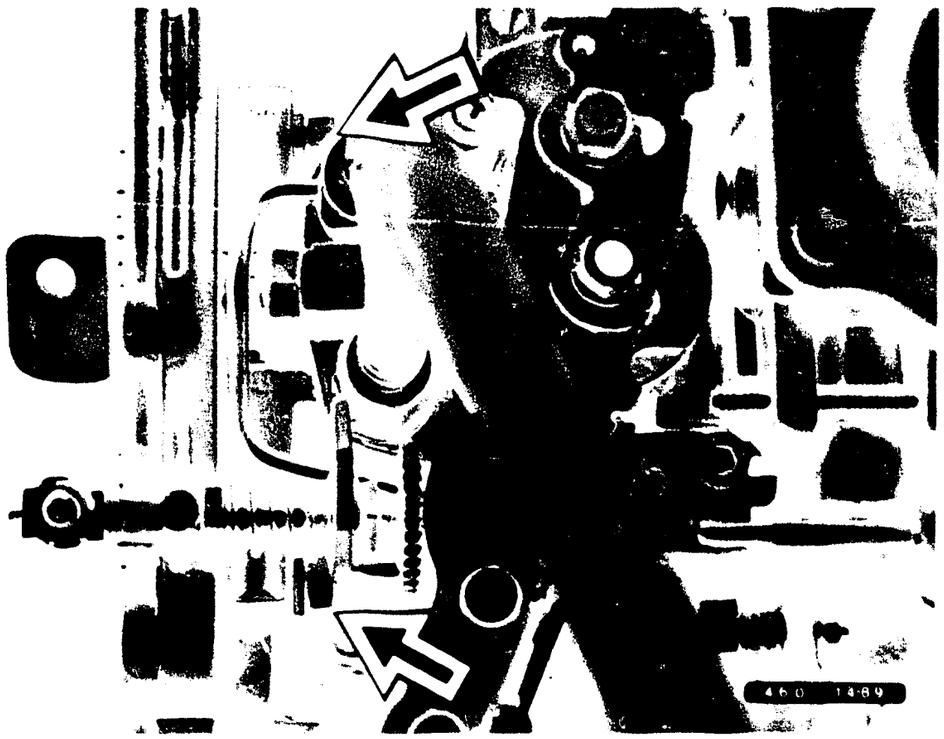
Note:

Counterhold delivery-valve holders to prevent them from loosening.

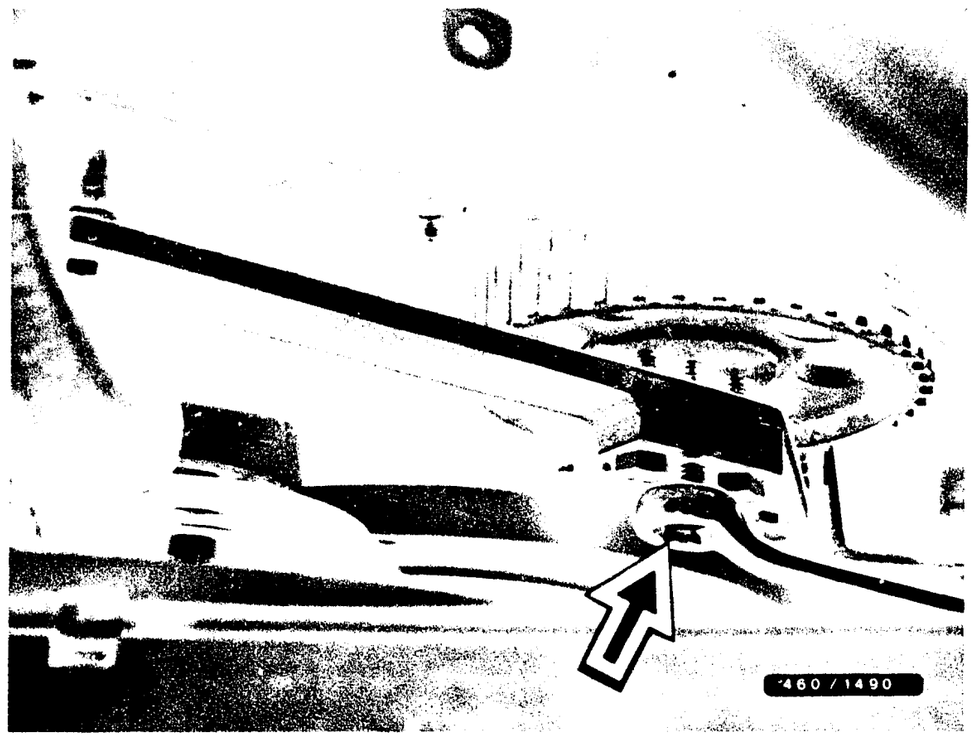


Unscrew fastening screws (1) on rear angle support of the fuel-injection pump (figure a/b).

Loosen fastening screws (2) on distributor head (figure b).



Unscrew fastening nuts of fuel-injection pump at pump flange (arrows).



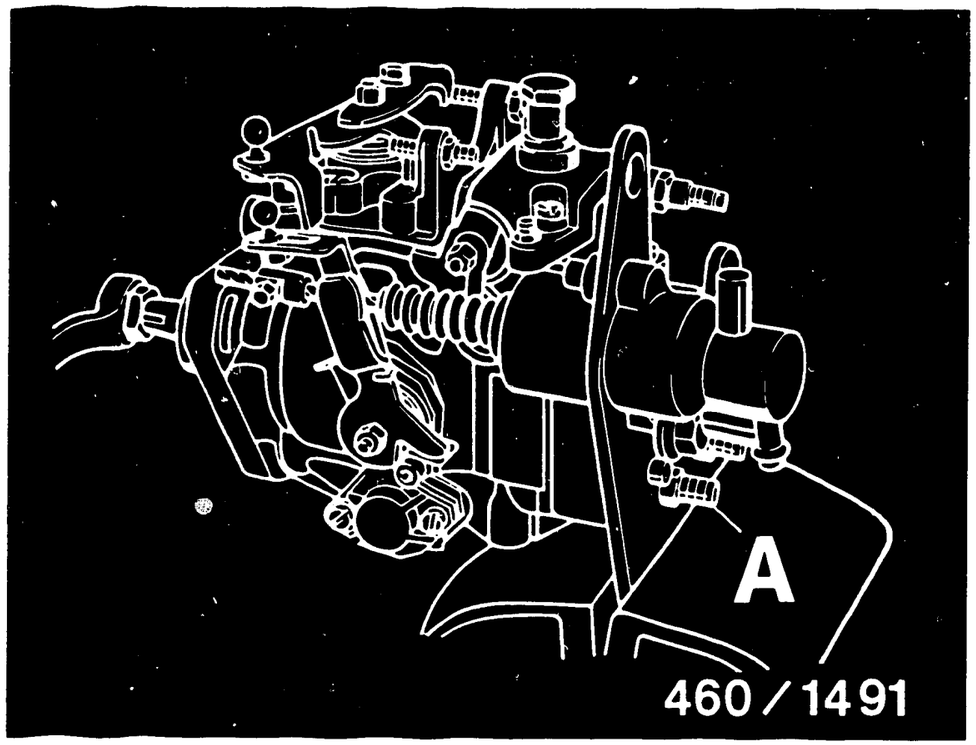
By screwing in the pressing-off screw in holding and pressing device KDEP 1156 (arrow), loosen the injection-pump gear from the cone of the input shaft and remove the fuel-injection pump from the flange.

Note:

In some cases the gear will be under tension and will be tight; if so, briefly strike the pressing device.

Do not remove the holding and pressing device.

Unscrew the pressing-off screw.



30. INSTALLING FUEL-INJECTION PUMP

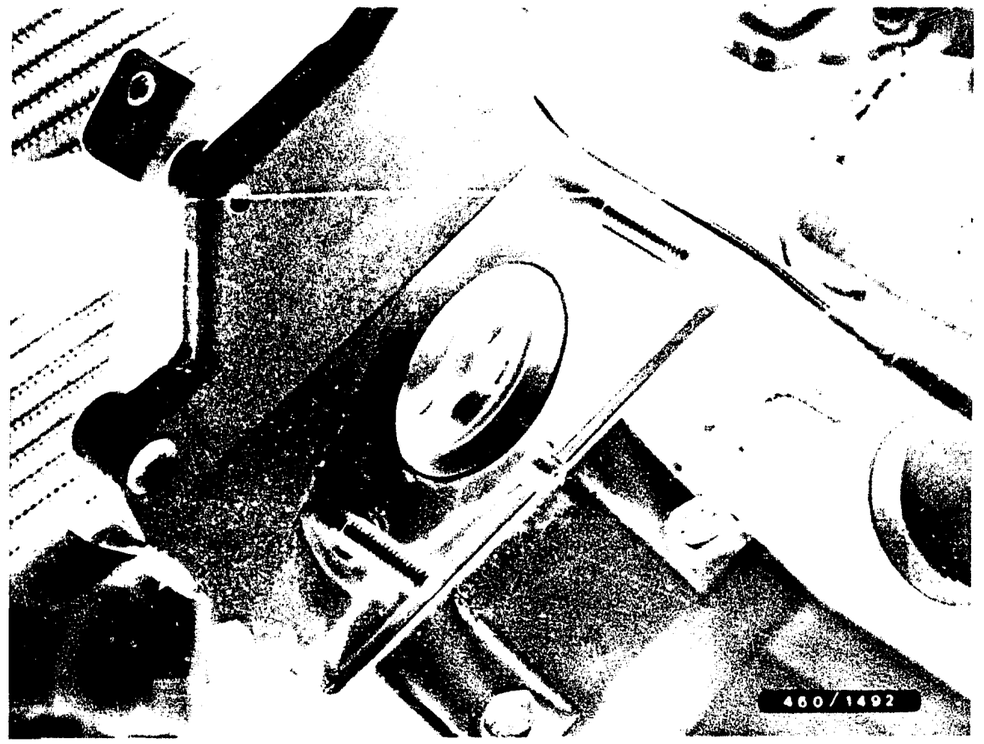
Clamp injection pump in vise.

Screw two hex nuts onto input shaft of fuel-injection pump and lock.

Turn input shaft until the keyway faces outlet "A" of the distributor head.

Unscrew hex nuts.

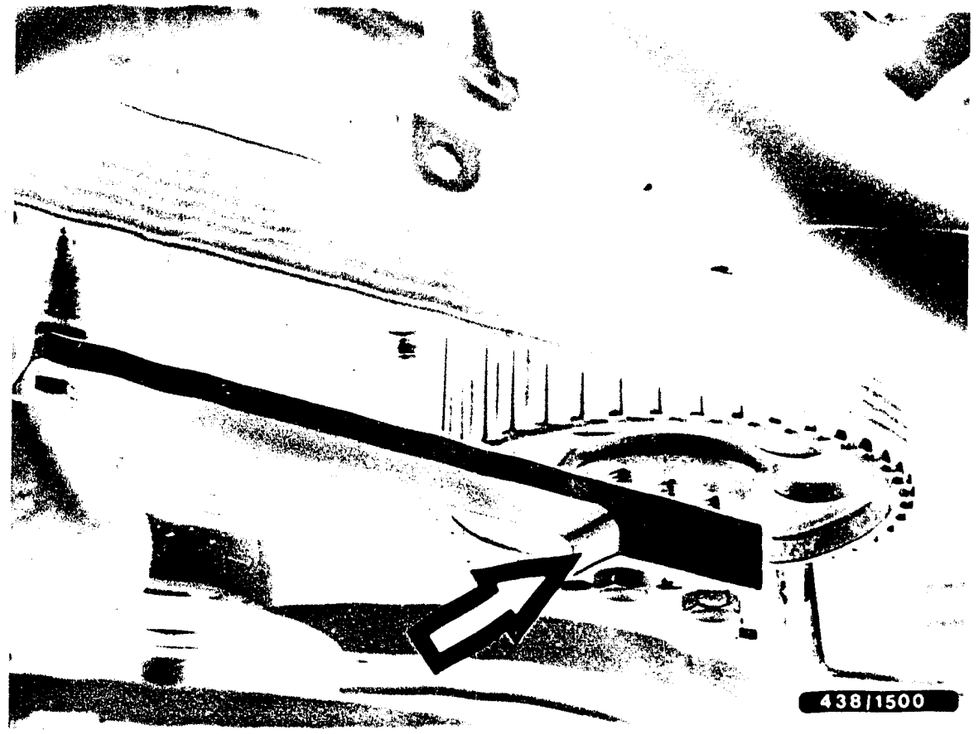
Insert Woodruff key into input shaft.



Guide fuel-injection pump into drive gear and lightly tighten fastening nuts at pump flange.

Note:

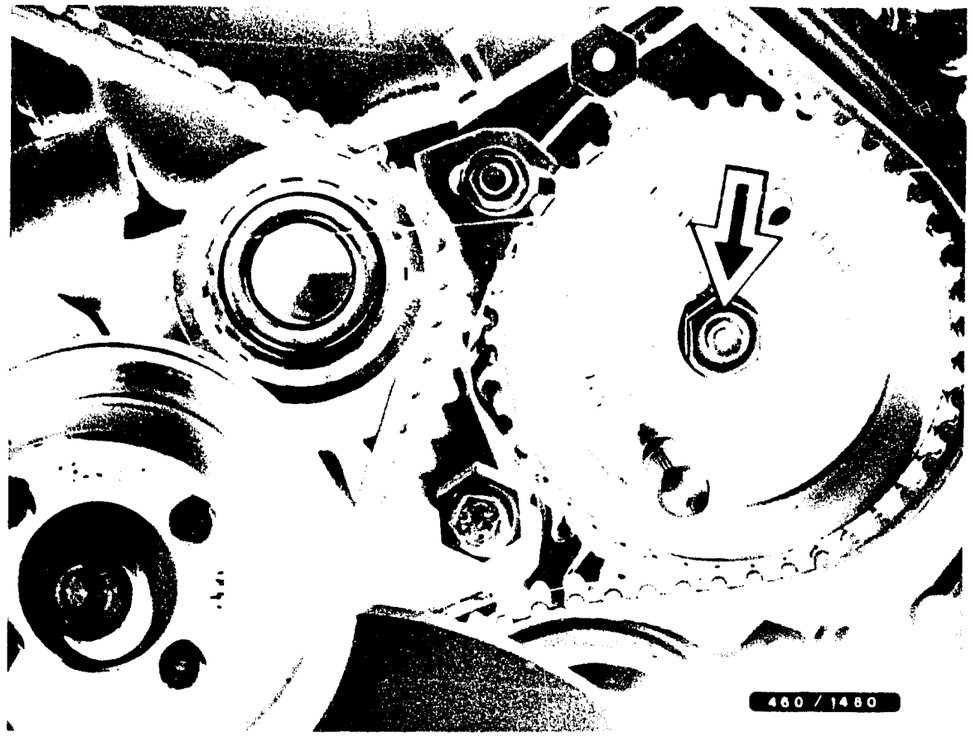
When inserting the fuel-injection pump, make sure Woodruff keys are correctly seated.



Remove holding and pressing device KDEP 1156 (arrow).

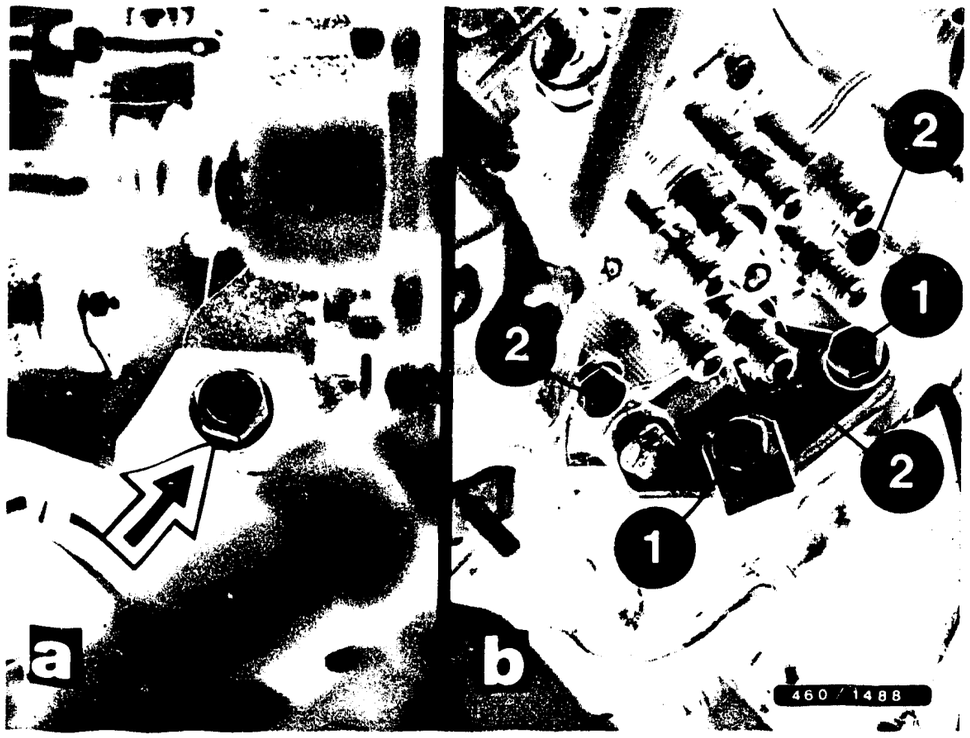
Note:

When removing the device, the drive gear for the fuel-injection pump must not slip off the cone of the input shaft, since this would make it necessary to reset the engine timing.



Screw on fastening nut for fuel-injection pump gear (arrow).

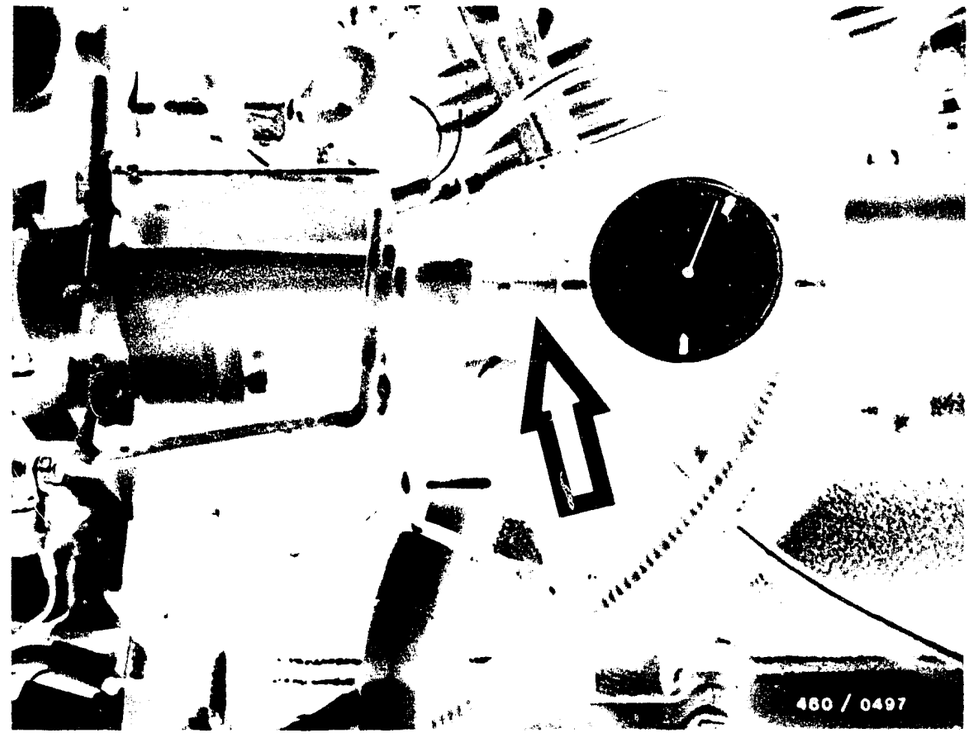
Fix injection-pump gear with setting mandrel KDEP 1138, tighten nut to 45 Nm, and remove mandrel.



Tighten fastening screws of angle support (1) to 25 Nm.

The fastening screws on the distributor head (2) should not be tightened due to the subsequent start-of-delivery adjustment.

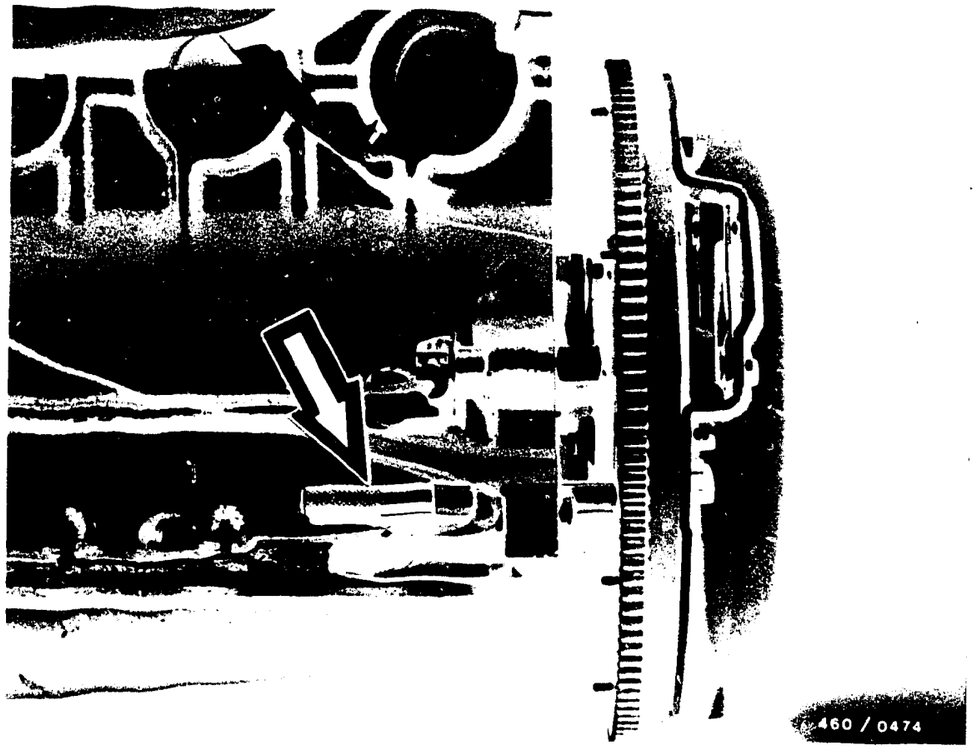
Remove setting device KDEP 1136/1139.



Unscrew bleeder screw from central screw plug (triangle-head bolt) on distributor head.

Screw measuring device KDEP 1085 (arrow) into the tapped hole of the bleeder screw.

Mount small dial indicator with measuring adapter in measuring device KDEP 1085.



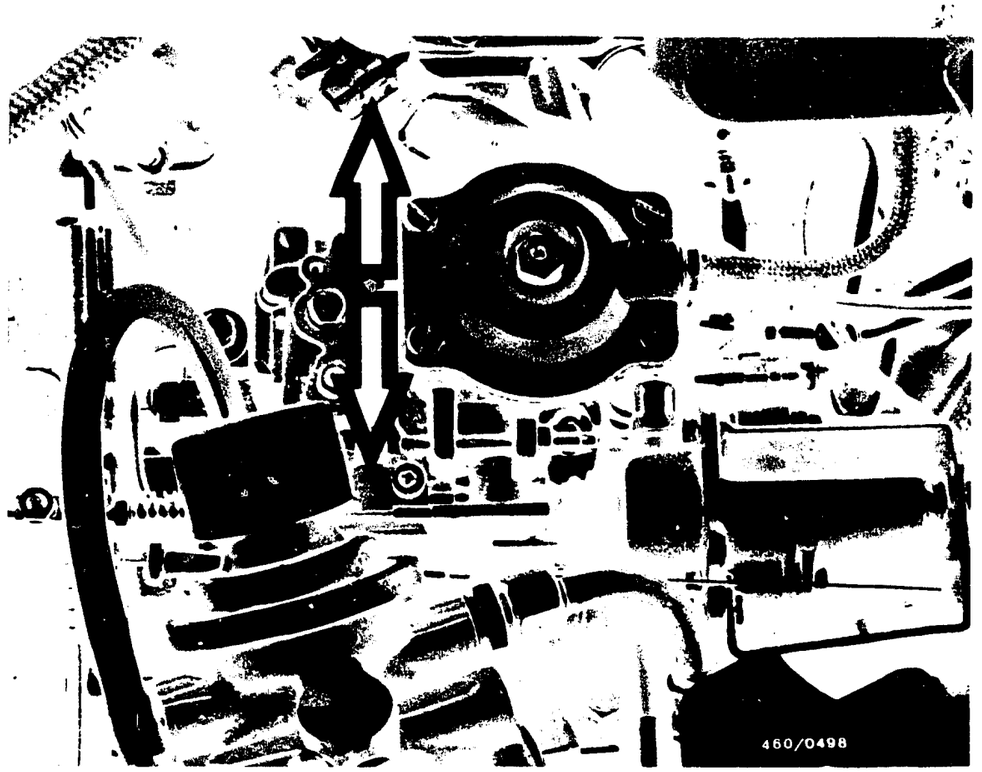
Pre-tension dial indicator about 2.5 mm.

Slowly turn the crankshaft against the direction of engine rotation until the needle of the dial indicator no longer moves.

Set dial indicator to "0".

Turn crankshaft in direction of engine rotation until the 1rst cylinder is at TDC.

Fix location of flywheel with setting mandrel KDEP 1139 (arrow).



In this position, the dial indicator should show a setting value of:

324d	0.74–0.02 mm after BDC
524td	0.74+0.02 mm after BDC.

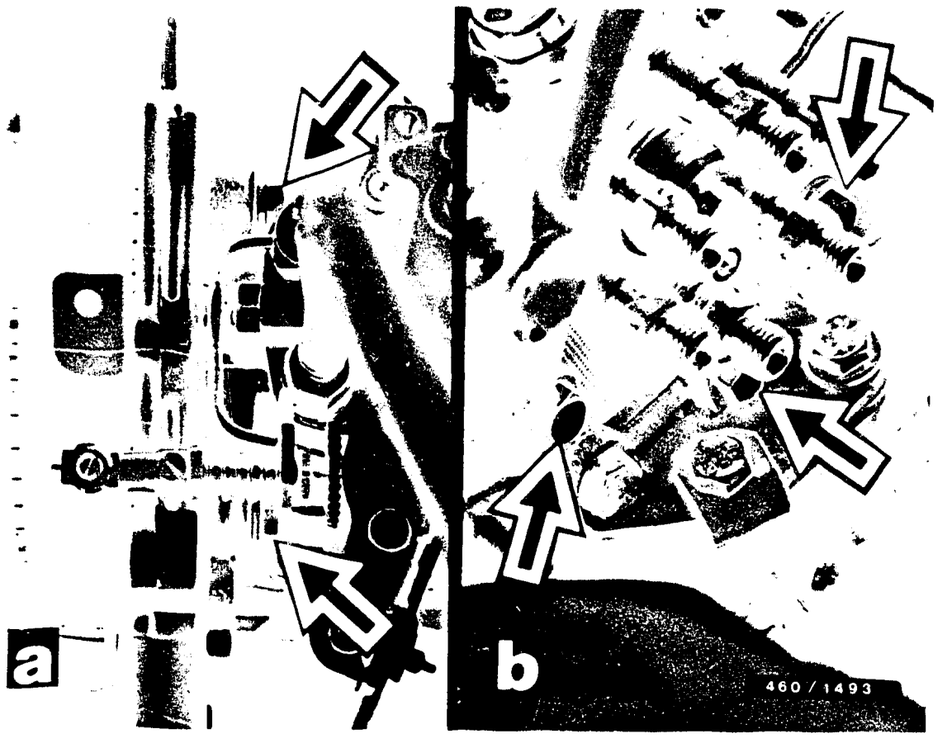
If correction is necessary, loosen the fastening screws of the fuel-injection pump (figure a/b – arrows).

Swivel fuel-injection pump until the appropriate setting value is obtained.

Note:

If the reading obtained is too small, swing the pump towards the engine.

If the reading is too large, swing the pump away from the engine.



Tighten fastening screws of fuel-injection pump to 25 Nm.

Remove setting mandrel KDEP 1139.

Turn crankshaft two full rotations and check adjustment.

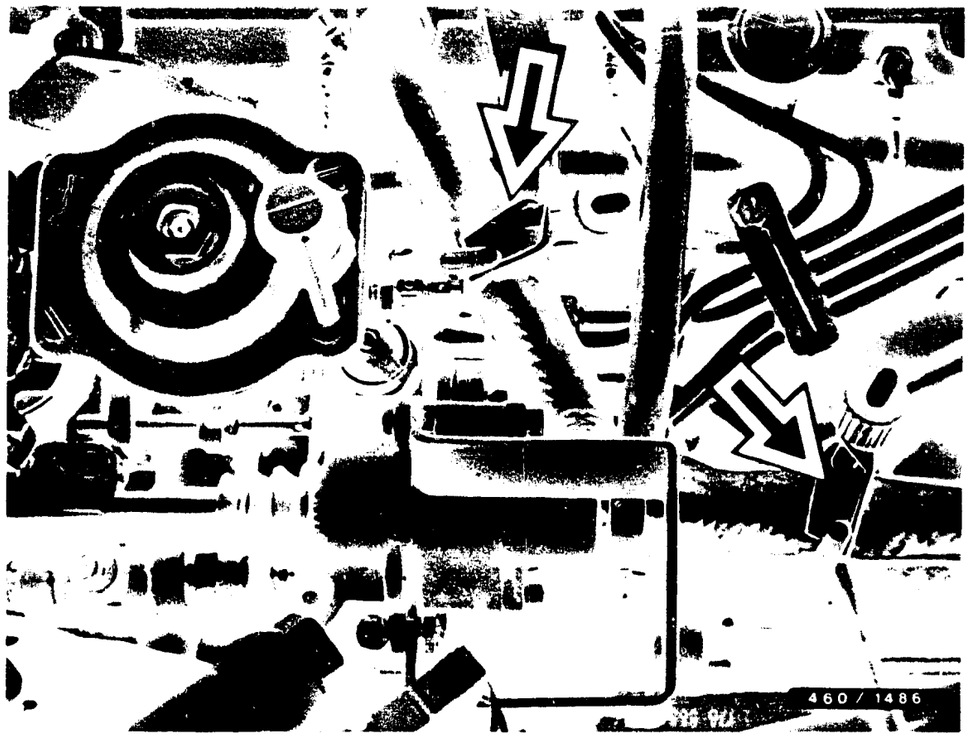
Remove measuring device KDEP 1085 with dial indicator.

Mount bleeder screw with new seal ring.

Connect injection tubing to delivery-valve and nozzle holders.

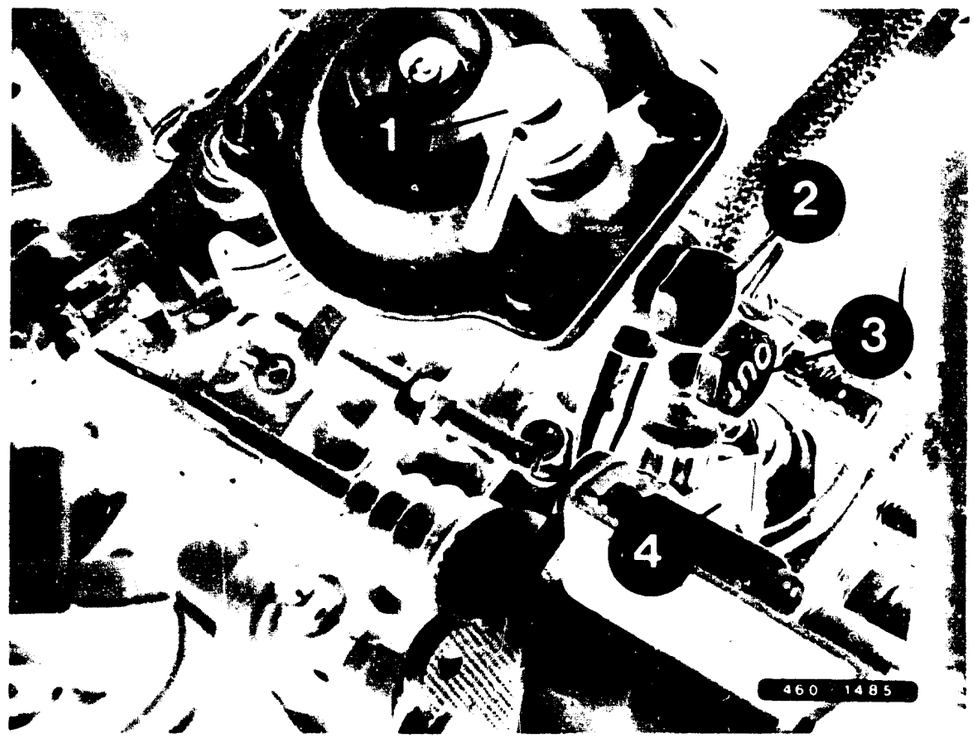
Note:

Counterhold delivery-valve holders to prevent them from turning.



Connect coolant hoses and fasten with hose clamps.

Remove spring clips (arrows).

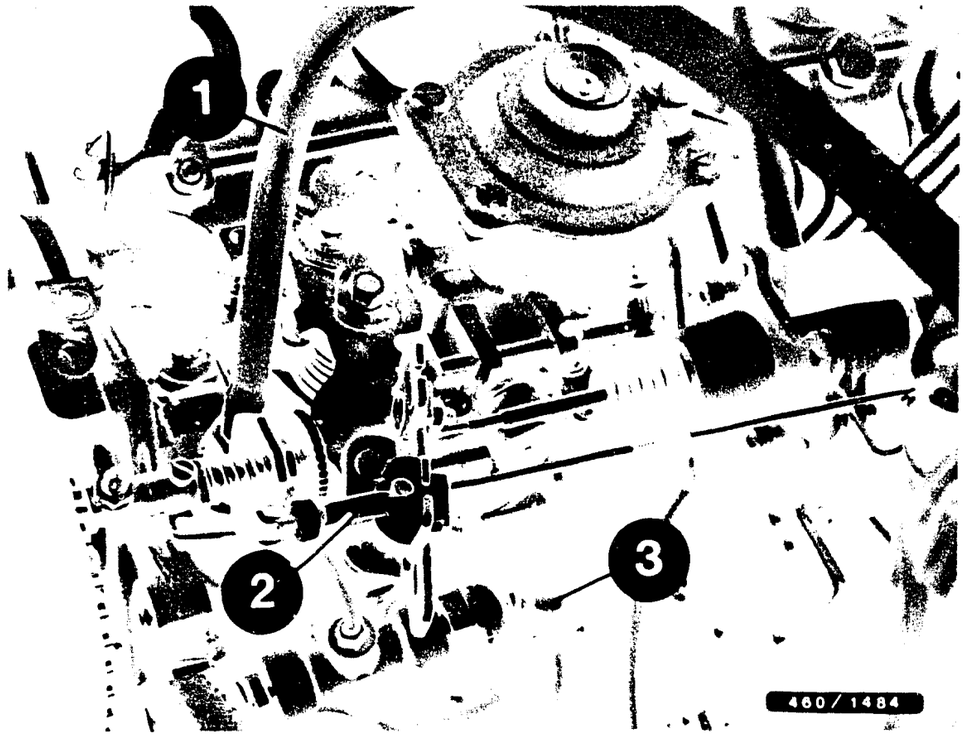


1 = Charge-air pressure connection (524td)
2 = Vacuum connection (324d)
3 = Fuel return line
4 = Electrical lead

Install fuel return line, electrical leads at shutoff solenoid, vacuum connection (324d) or charge-air pressure connection (524td).

Note:

The return-line reducer bushing is provided with restriction borings, and is designated on the screw head with the word "Out".

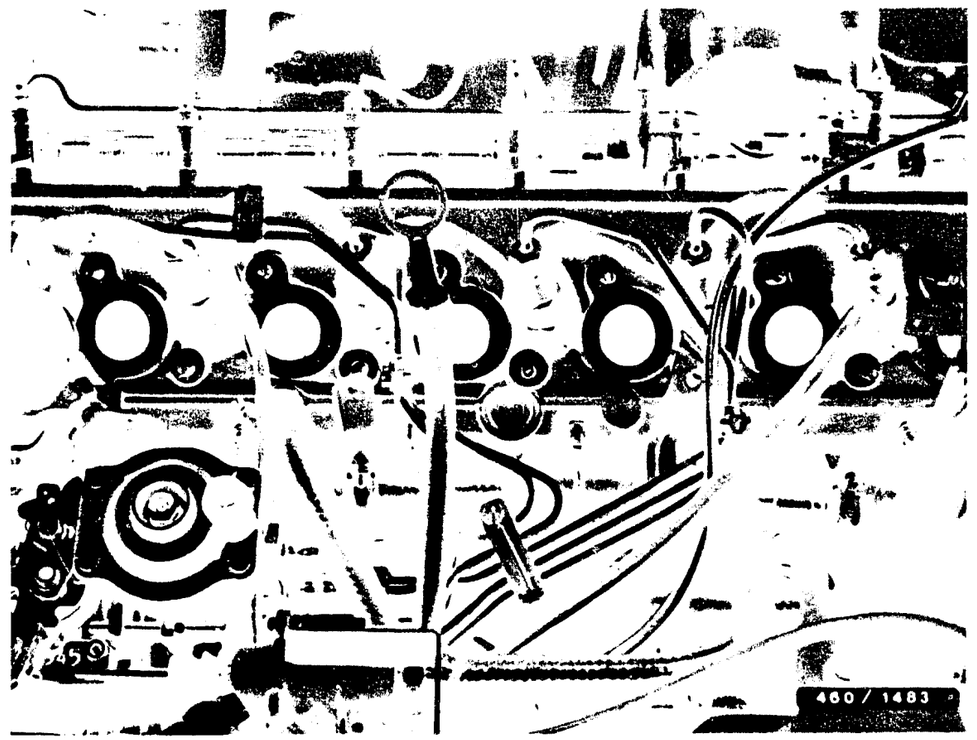


1 = Fuel supply line
2 = Bowden cable (accelerator pedal)
3 = Electrical lead

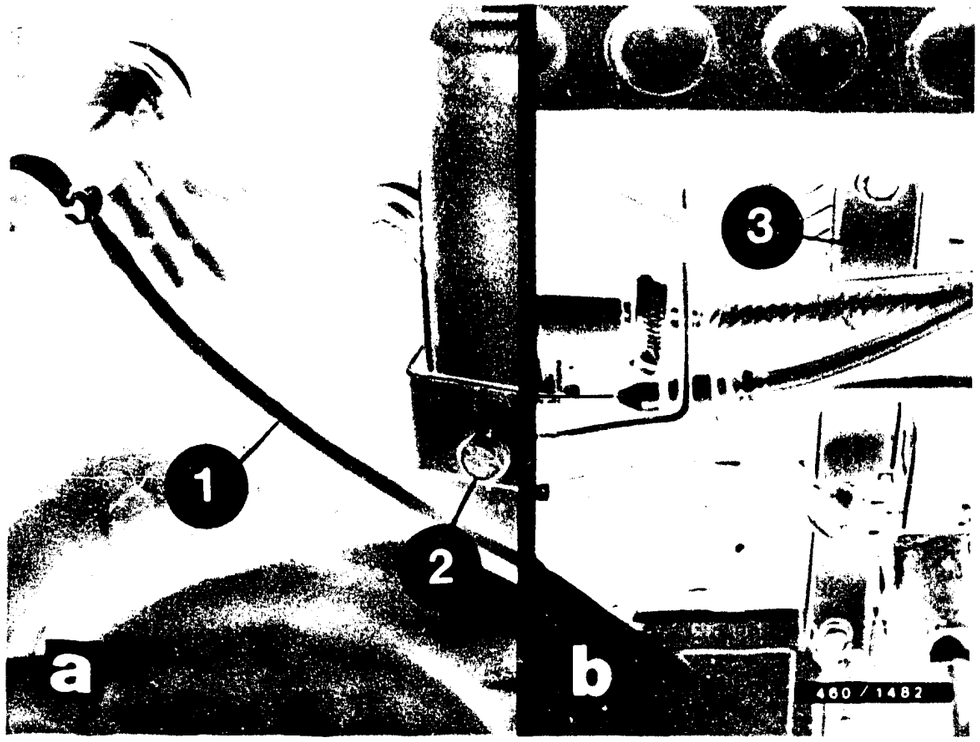
Screw on fuel supply line at fuel filter.

Engage bowden cable at control lever.

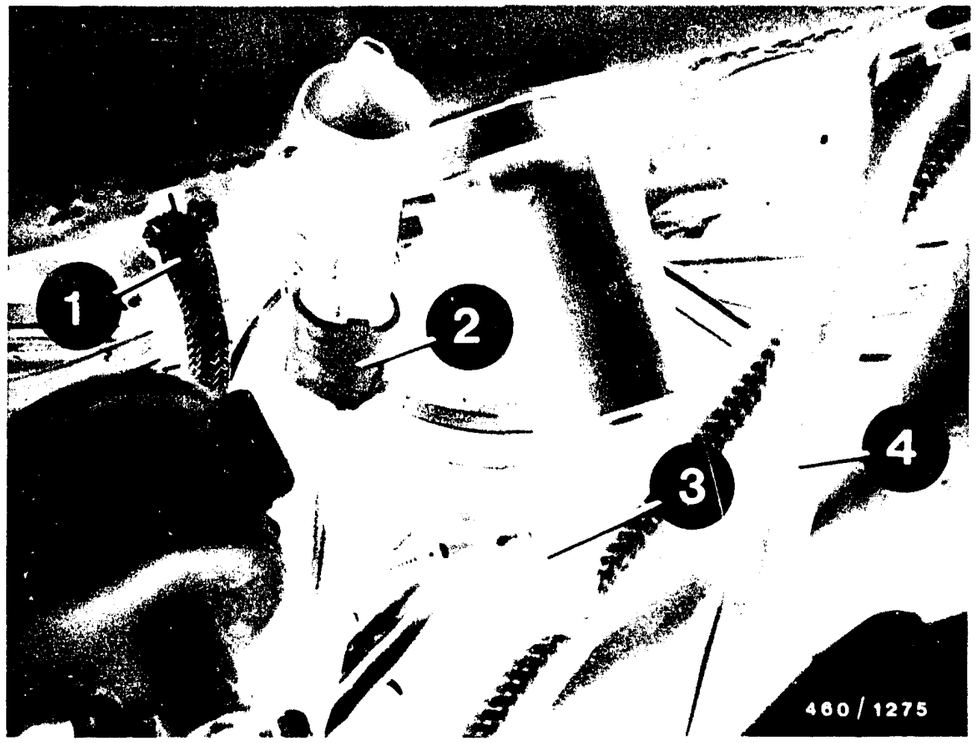
Plug electrical lead at KSB solenoid-operated valve.



Install collecting manifold with new induction seals.



1 = Vacuum hose
2 = Cable clamp
3 = Bracket



1 = Hose line
2 = Clamp
3 = Plug connection
4 = Support

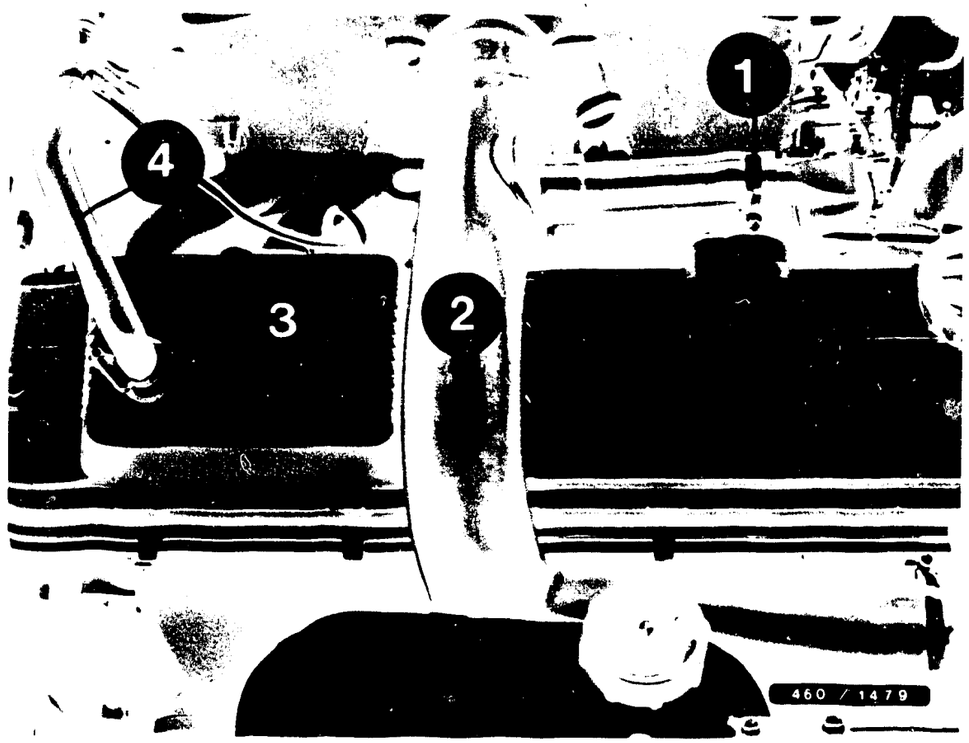
324d

Connect vacuum hose.

Install cable clamp and bracket on collecting manifold.

524td

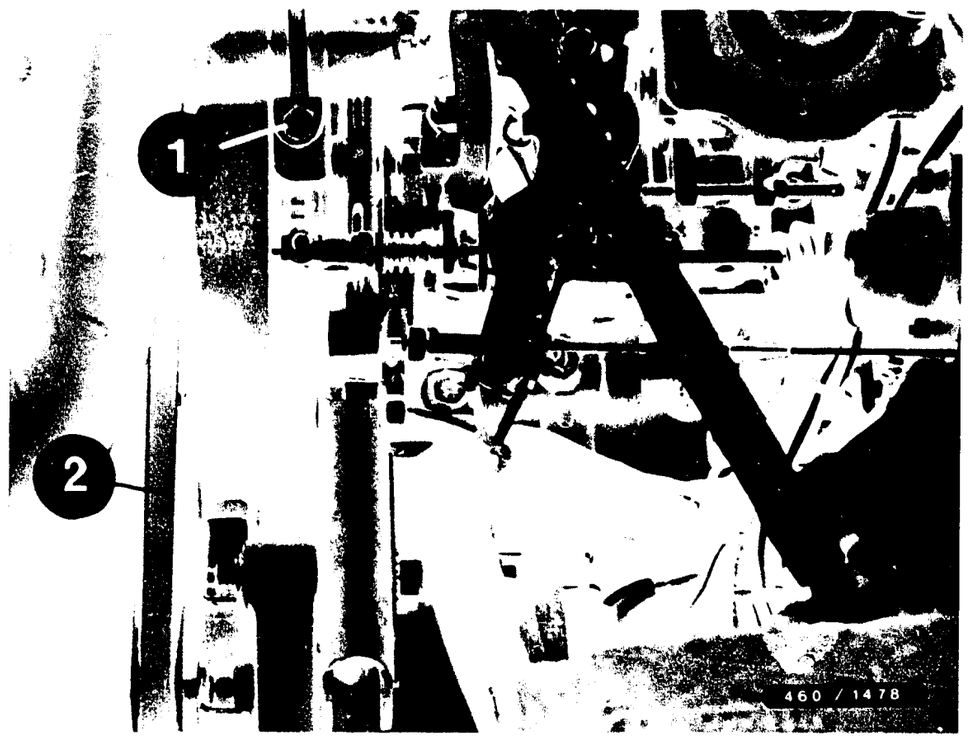
Connect hose line to LDA, fastening clamp for dipstick, plug connection at blow-off valve, and support for charge-air pipe.



1 = Crankcase ventilation
2 = Connection hose
3 = Cylinder-head cover
4 = Vacuum hose

Install crankcase ventilation, connection hose between turbo-supercharger/air filter and collecting manifold, and cylinder-head cover.

Connect vacuum hose to vacuum pump and negative cable to battery.

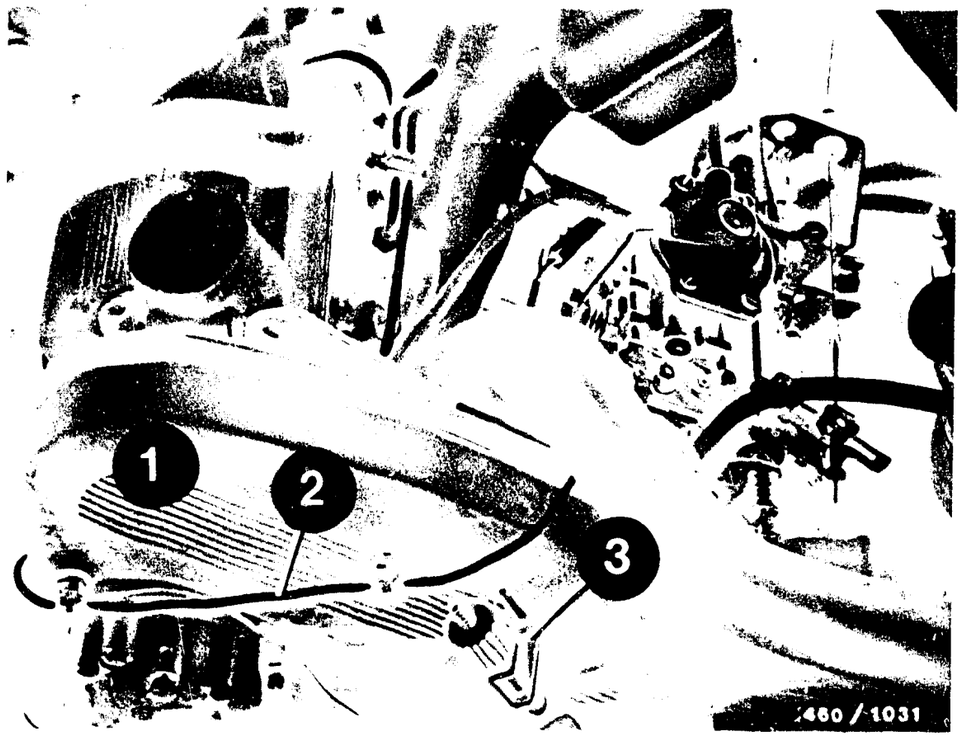


1 = Hose clamp

2 = V-belt

Affix coolant-hose clamp.

Position and tighten generator V-belt.



1 = Toothed-belt cover
2 = Wiring harness
3 = Spring clip

Fastening wiring harness (not on 324d).

Connect coolant hose to water pump and remove spring clip.

Tighten hose clamp.

* Bleeding fuel system (324d)

Fill fuel filter and fuel-injection pump with diesel fuel.

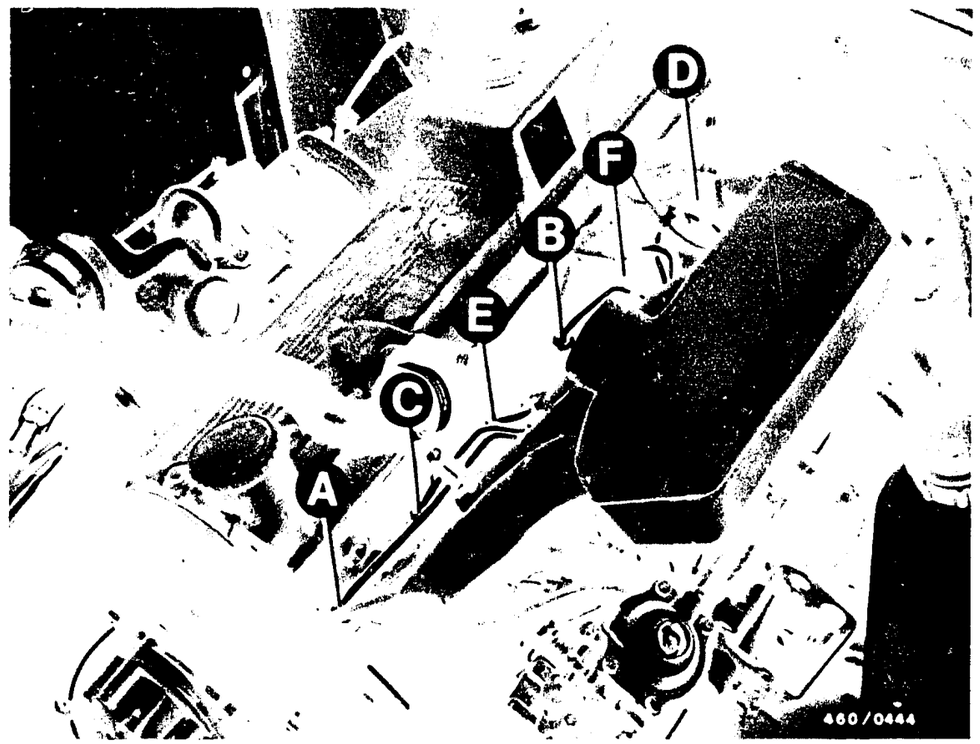
Tighten hose connections at filter cover.

Close bleeder screws at fuel filter (arrow).

Loosen bleeder screw at fuel-injection pump and screw out several turns (arrow).

Operate starter of engine without pre-heating.

Re-tighten bleeder screw when fuel exits from the bleeder hole of the injection pump free of bubbles.

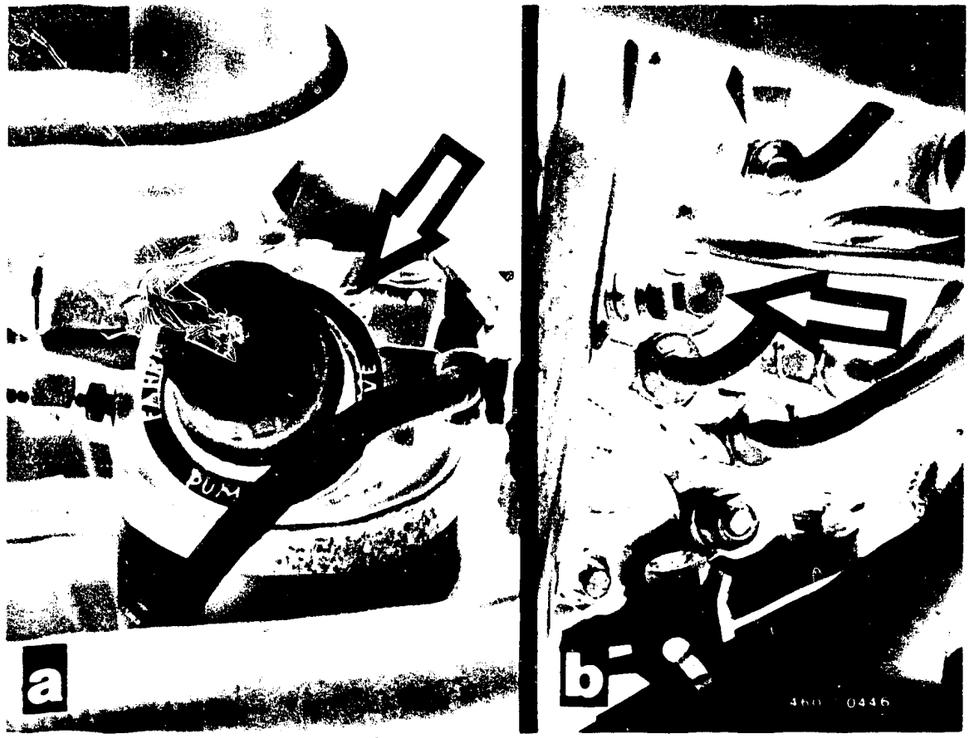


Loosen injection-tubing union nuts (A...F) at the injection-nozzle holders.

Operate engine starter until fuel exits at the union nuts of the nozzle holders.

Tighten union nuts.

Operate starting motor until engine starts.



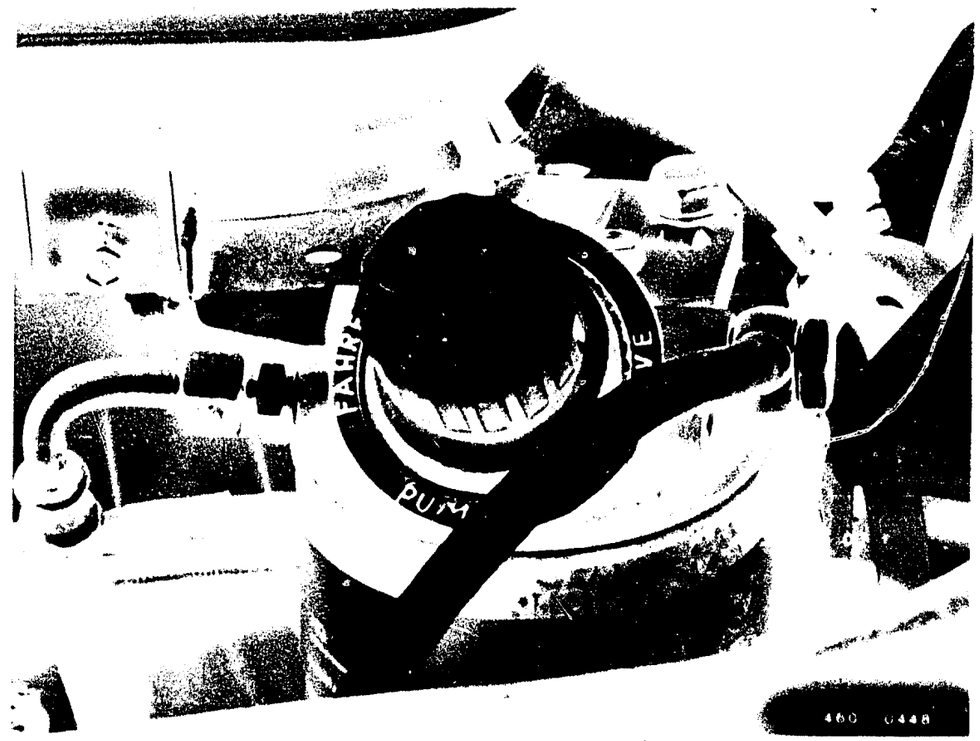
* Bleeding fuel system (524td)

Fill fuel filter and fuel-injection pump with diesel fuel.
Loosen bleeder screw at fuel filter (figure a - arrow) and fuel-injection pump (figure b - arrow) several turns.

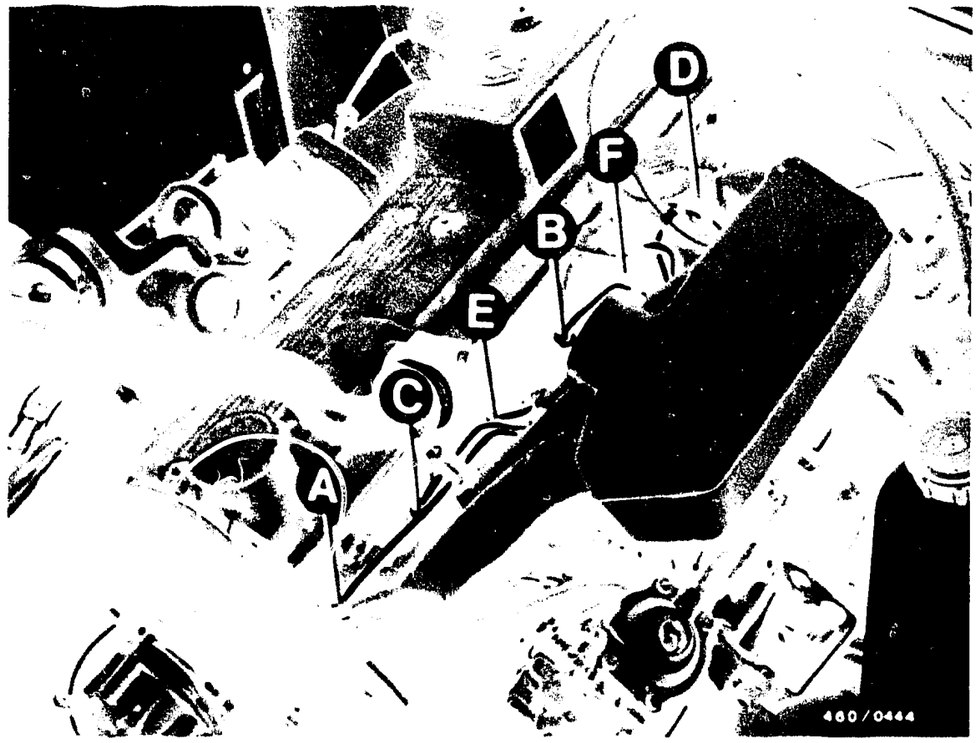
Turn hand primer at fuel filter to pump position (arrows vertical).

Operate hand primer until fuel exits at the bleeder screw of the fuel filter bubble-free.
Tighten bleeder screw at fuel filter.

Continue operating hand primer at fuel filter until the fuel exiting at the bleeder screw of the fuel-injection pump is also bubble-free.
Tighten bleeder screw of fuel-injection pump.



Turn hand primer back by 90° so that the bypass valve in the fuel-filter head is open.

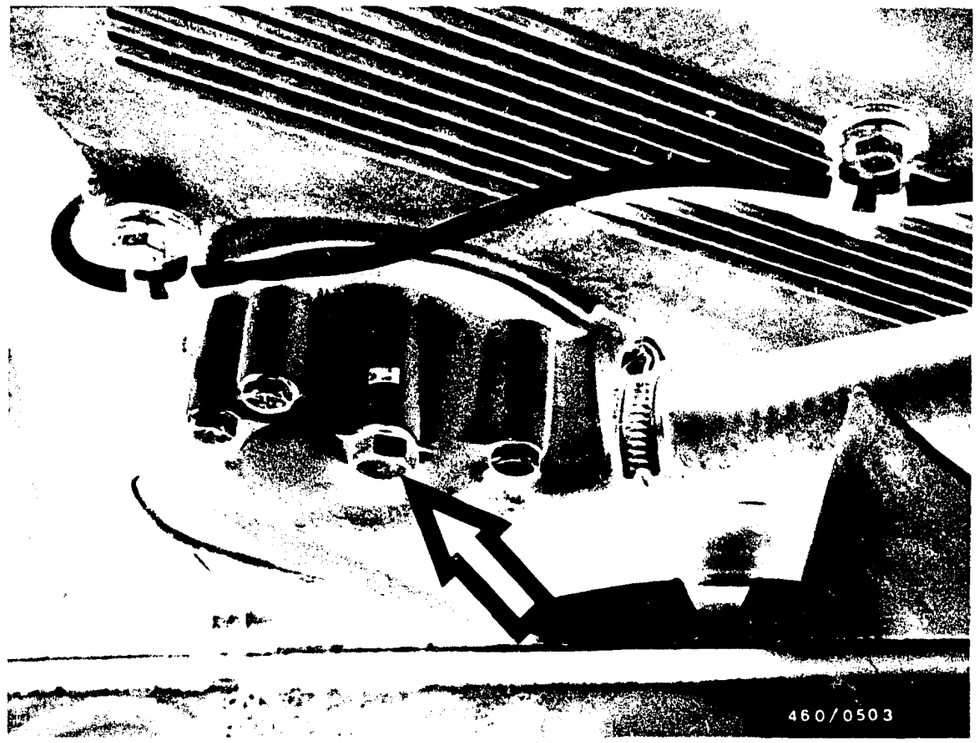


Loosen union nuts for fuel-injection tubing (A...F) at the injection-nozzle holders.

Operate engine starter until fuel exits at union nuts of the nozzle holders.

Tighten union nuts.

Operate starter until engine starts.



* Bleeding cooling system

Add coolant until it reaches the mark in the expansion tank.

Seal expansion tank.

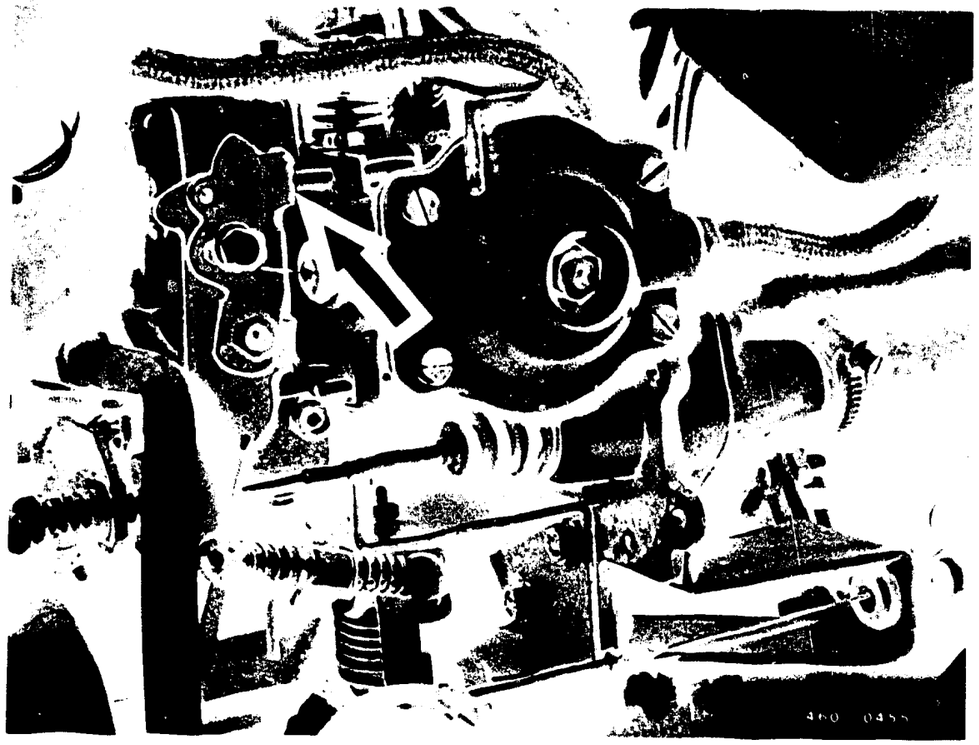
Fully open heater controls.

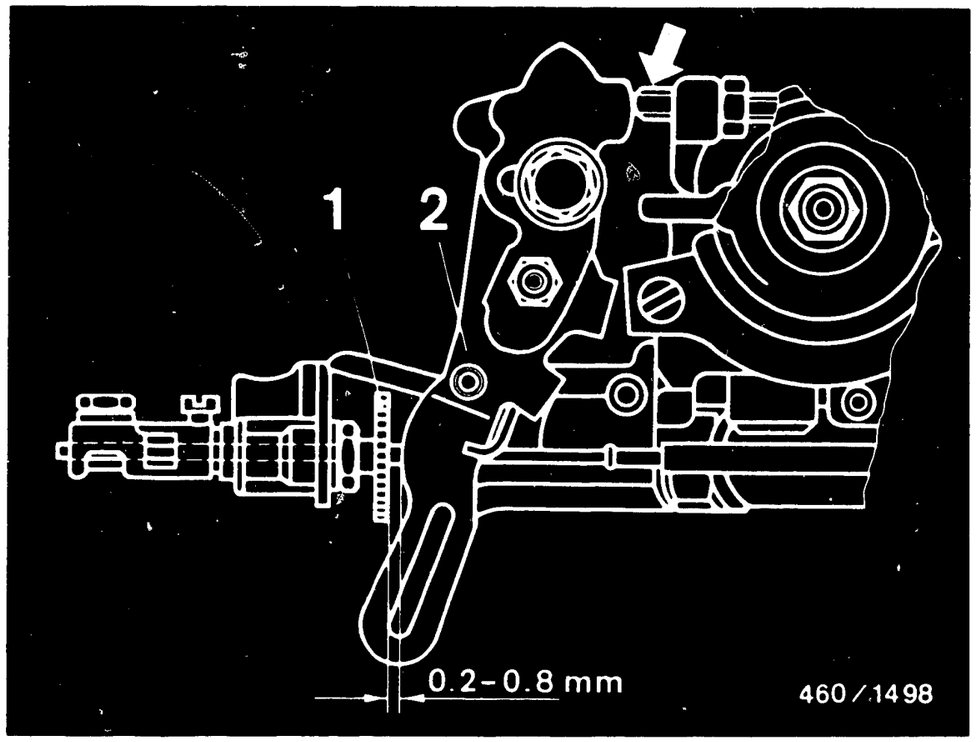
Let engine run until it reaches normal operating temperature.

Loosen bleeder screw (arrow) at water pump until coolant escapes.

Tighten bleeder screw.

Affix engine-compartment guard to bottom of engine (324d).





1 = Knurled-head screw 2 = Control lever

* Setting idle speed

Connect tachometer (e.g. photoelectric) to engine.

Apply a reflex mark to the crankshaft for this purpose.

Aim digital hand tachometer at this reflex mark and determine engine speed optically.

Start engine and let run at idle speed.

Note:

The engine must be at normal operating temperature for setting the idle speed.
Engine-oil temperature > + 60°C.

The temperature-controlled idle increase must be inoperative.

The control lever rests against the idle-speed adjusting screw (arrow).

Use the idle-speed adjusting screw (arrow) to adjust the idle speed to
750 + 50 min^{-1} .

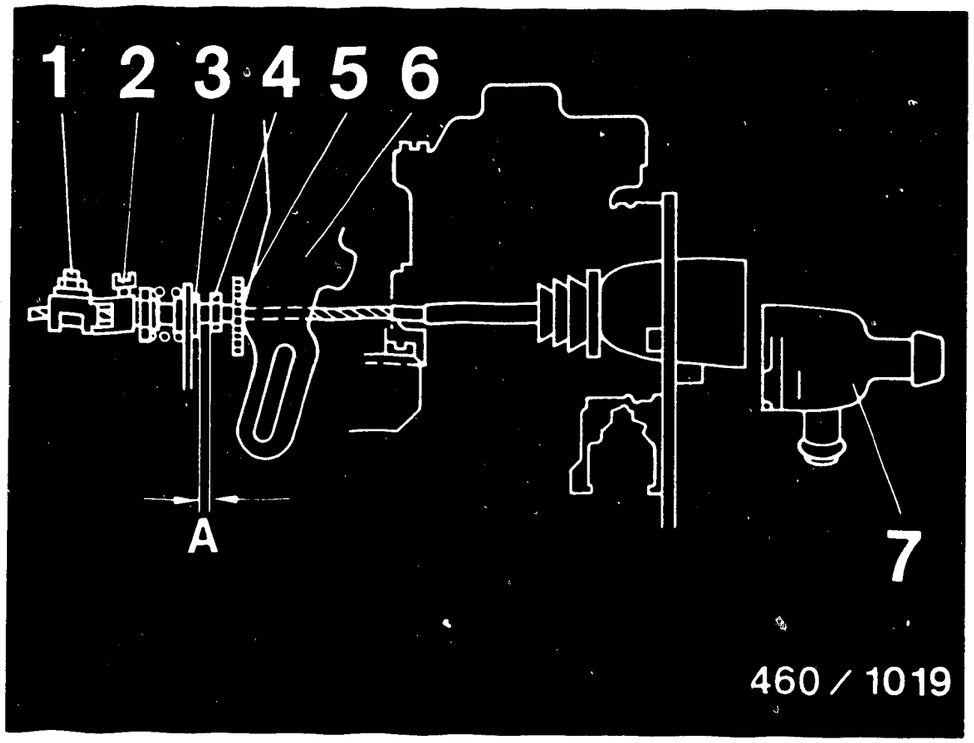
Turn the knurled-head screw until there is a play between the screw and the control lever of 0,2...0,8 mm.

Note:

The engine camshaft and injection pump are driven at half the engine speed.

After adjustment, lock and seal the adjusting screw.

After adjustment of the idle speed, check and if necessary adjust the play of the bowden cable for the accelerator pedal and the position of the engine-speed control lever (only on vehicles with automatic transmission).



* Adjusting idle increase
Checking overall travel

Remove the housing for the temperature-dependent idle increase (7).

Measure dimension "A" between the locknut of the knurled-head screw (4) and the band of the angle bracket (3).

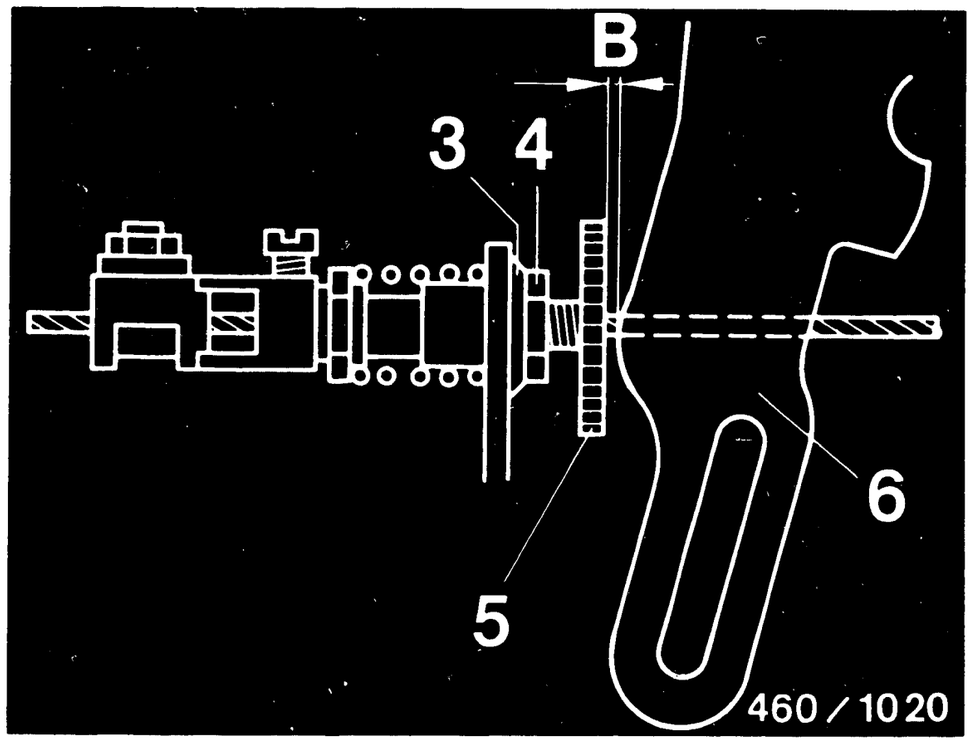
Nominal value: 5,1...5,9 mm

In measuring, the control lever (6) must rest against the knurled-head screw (5).

Adjustment:

Loosen the clamping piece (1 and 2) and push it until dimension "A" is within tolerance.

Fasten clamping piece (1) first, and then clamping piece (2).
Mount housing (7).



* Checking and adjusting clearance from control lever to knurled-head screw.

Adjusting with engine warm

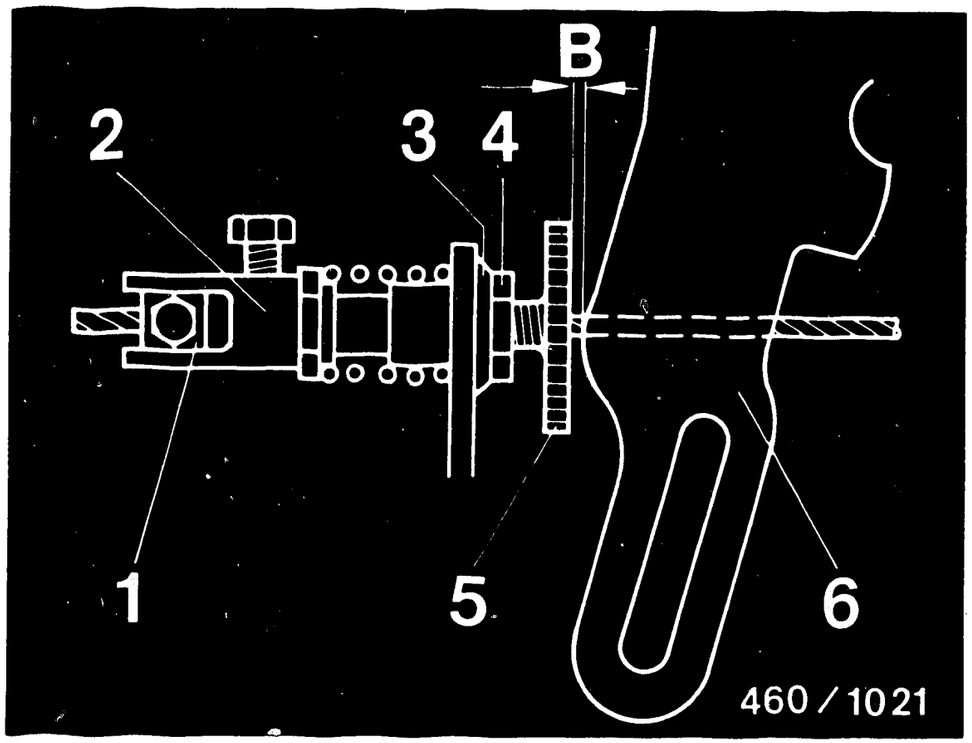
Prerequisites:

- * Warm idle-speed setting OK.
- * Coolant temperature > 25°C.
- * Lock nut (4) rests against collar (3).
- * Control lever (6) resting against idle-speed adjusting screw.

Measure clearance "B" between control lever (6) and knurled-head screw.

Nominal value: B = 0,2...0,8 mm

If the nominal value is not reached, loosen lock nut (4) and turn the knurled-head screw (5) until dimension "B" lies within tolerance.



* Checking and adjusting clearance of control lever to knurled-head screw

Adjustment with engine cold
Loosen clamping piece (2) and turn by 90° (clamping piece (2) slides over clamping piece (1)).

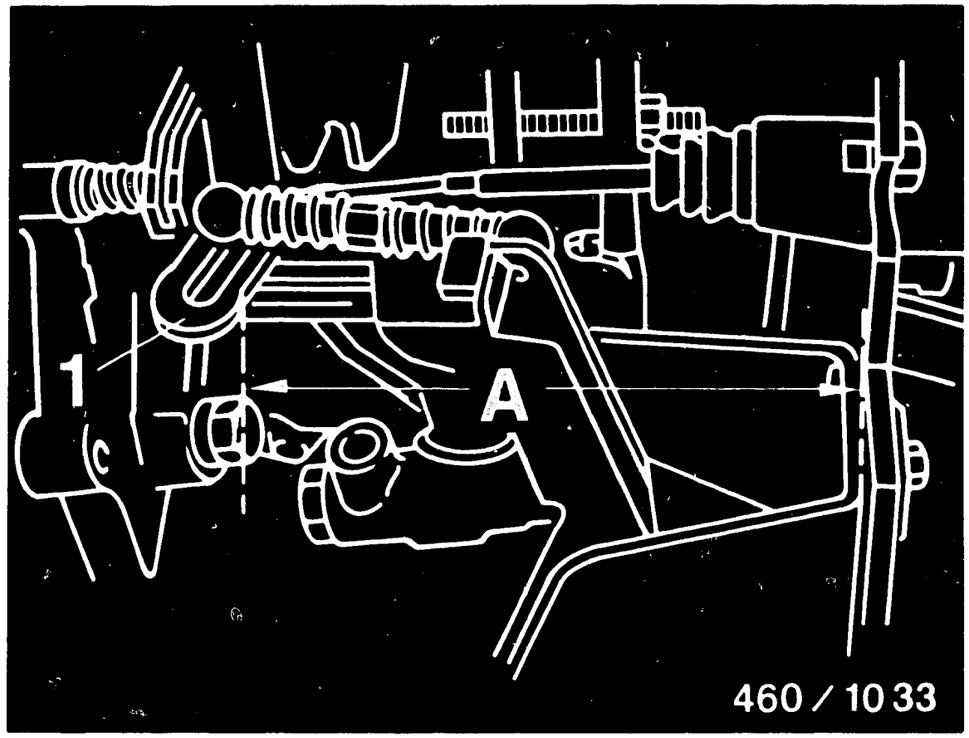
Prerequisites:
* Warm idle-speed setting OK.
* Lock nut (4) resting against collar (3).
* Control lever (6) resting against idle-speed adjusting screw.

Measure clearance "B" between control lever (6) and knurled-head screw (5).

Nominal value: B = 0,2...0,8 mm

If the nominal value is not reached, loosen lock nut (4) and turn knurled-head screw (5) until dimension "B" lies within tolerance.

Turn clamping piece (2) by 90° again and fasten.

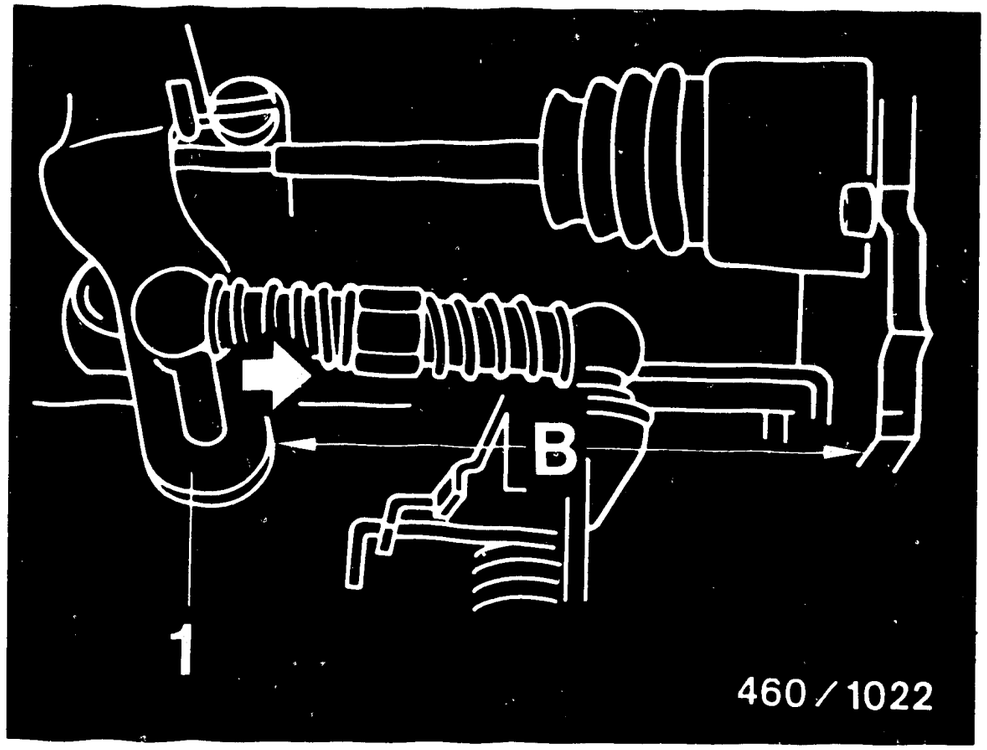


* ADJUSTING ENGINE-SPEED CONTROL LEVER
(Only on vehicles with automatic transmission)

Prerequisites:

* Idle speed correctly set.
* Engine at normal operating temperature.
* Control lever (1) resting against idle stop.

Measure and note down dimension "A".



Press control lever (1) against full-load stop.

Measure and note down dimension "E".

Subract dimension "B" from dimension "A".
A – B = C

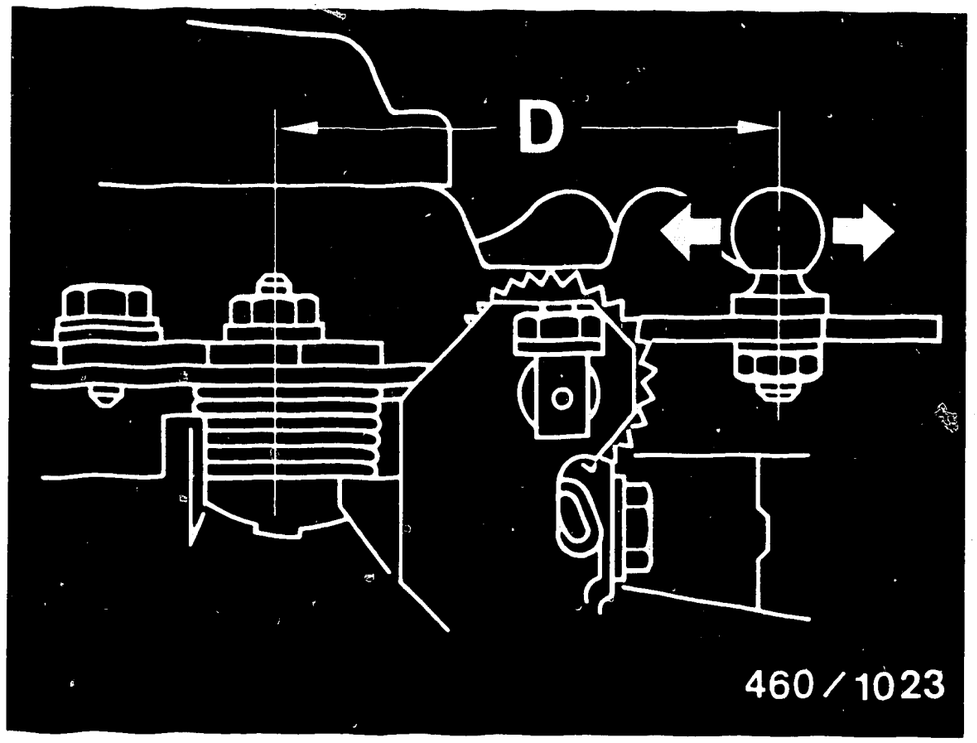
Example: A = 98 mm
B = 47 mm
C = 51 mm

If the calculated value of C = 51 mm,
then dimension "D" from the table = 61.6 mm.

Derive dimension "D" for the adjusting linkage from the following table.

Adjustment table:

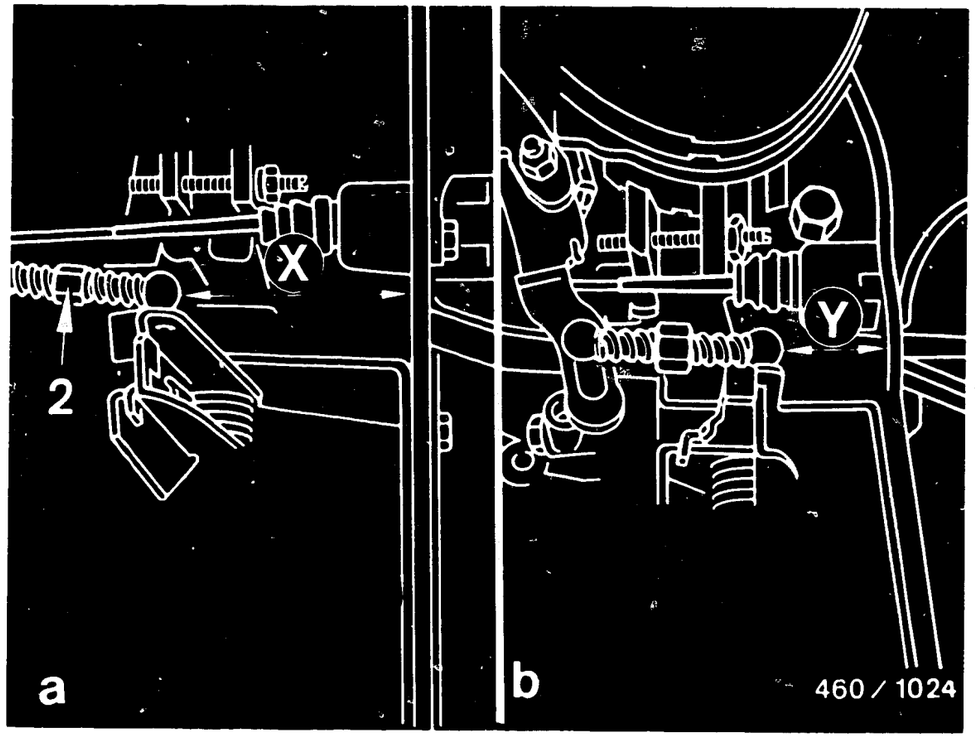
C	(mm)	41	41.5	42	42.5	43	43.5	44	44.5
D	(mm)	78.1	77.0	76.0	74.9	73.9	73.0	72.0	71.1
C	(mm)	45	45.5	46	46.5	47	47.5	48	48.5
D	(mm)	70.3	69.4	68.6	67.8	67.0	66.3	65.6	64.9
C	(mm)	49	49.5	50	50.5	51	51.5	52	52.5
D	(mm)	64.2	63.5	62.9	62.3	61.6	61.0	60.5	59.9
C	(mm)	53	53.5	54	54.5	55	55.5	56	
D	(mm)	59.4	58.8	58.3	57.8	57.3	56.8	56.4	



Disengage the connecting linkage at the control lever.

Measure dimension "D" and compare with adjustment value from table.

If necessary, adjust dimension "D" by altering the ball head (arrows).

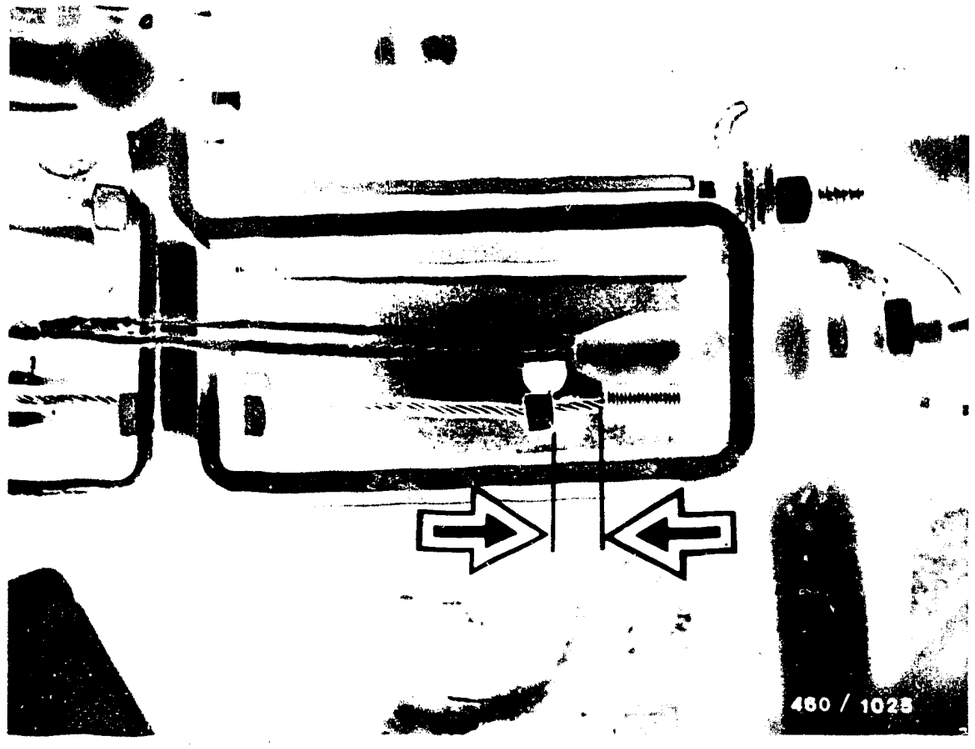


1. Check dimension "X" in idle position.
   Figure (a)
   Setting dimension = 68 ± 0.5 mm
   Correct setting at connecting linkage (2).

2. Check full-throttle position (figure b).
   Dimension "Y" must be 28.1 ... 29.1 mm.
   If dimension "Y" is incorrect, repeat the entire setting process.

Note:

After coordination of the engine-speed control lever to the lever position of the automatic transmission, check the adjustment of the bowden cable for the accelerator pedal (adjust).



* KICK-DOWN ADJUSTMENT

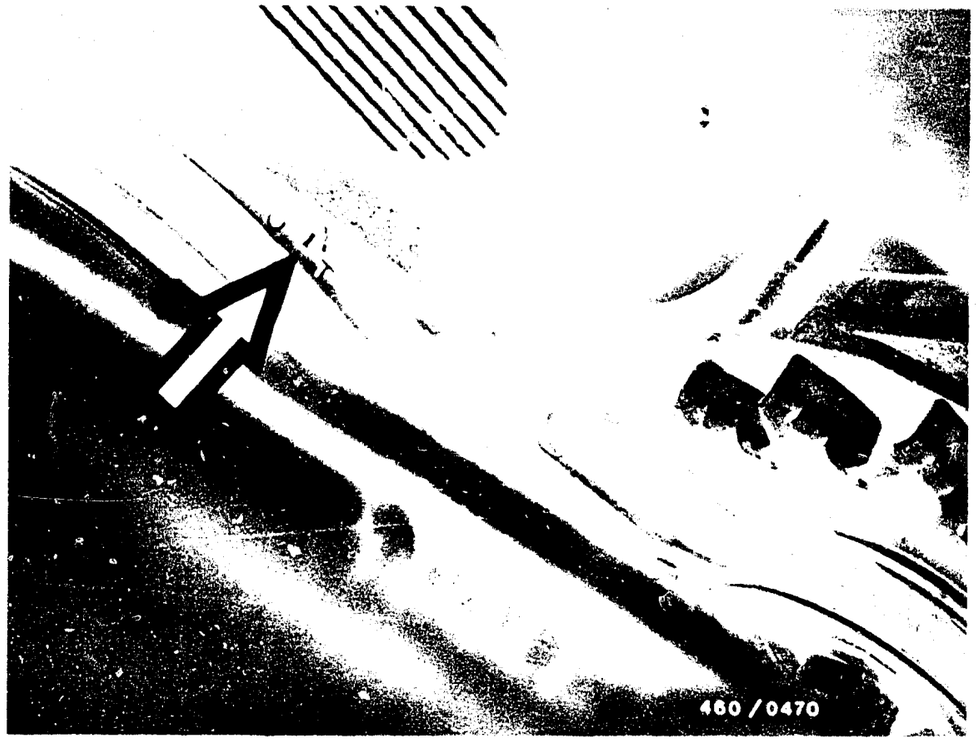
Prerequisite:

* Engine at normal operating temperature, coolant-water temperature + 78°C

Adjustment:

1. At idle speed, there must be a clearance between the bowden cable and guide sleeve of 0.5 mm.

2. Switch off engine, depress accelerator pedal down to the kick-down point, setting dimension between cable clamp and guide sleeve = 30 mm. Adjust by alteration of the guide sleeve.



31. CHECKING AND ADJUSTING ENGINE TIMING

31.1 Checking engine timing

Disconnect negative lead from battery.

Turn crankshaft until the TDC mark (cylinder 1) on the belt pulley is in alignment with the reference mark (arrow).

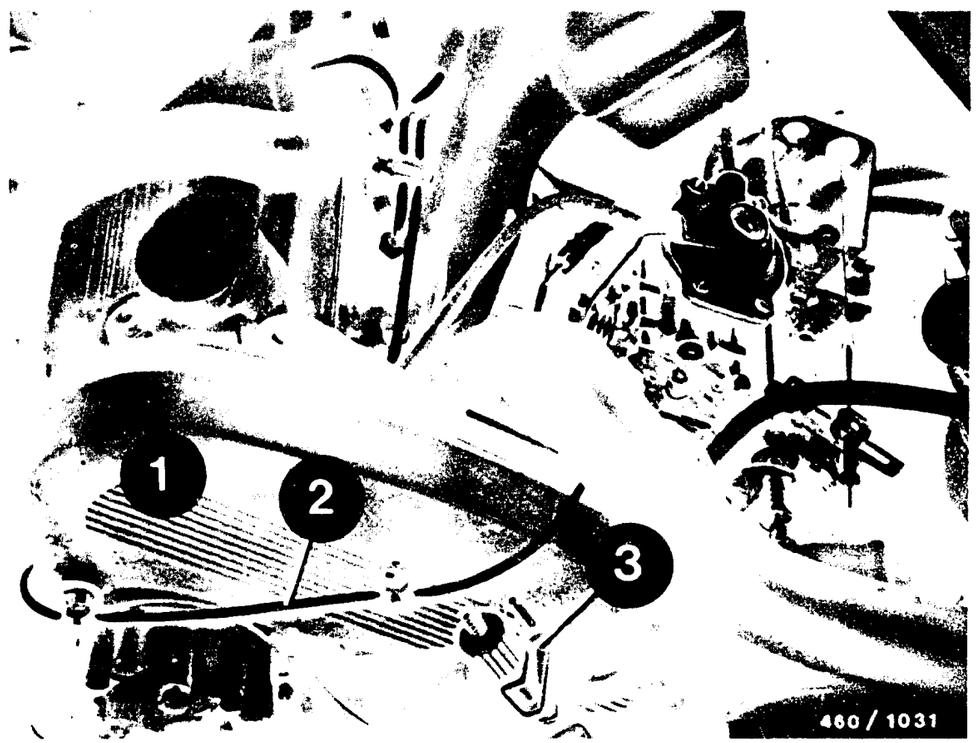
The piston of the 1rst cylinder is at TDC (valves of cylinder 6 at overlap).

Remove engine-compartment guard on underside of engine (324d).

1 = Hose clamp

2 = V-belt

Remove the coolant-hose clamp and V-belt from generator.



1 = Toothed-belt cover
2 = Wiring harness
3 = Spring clip

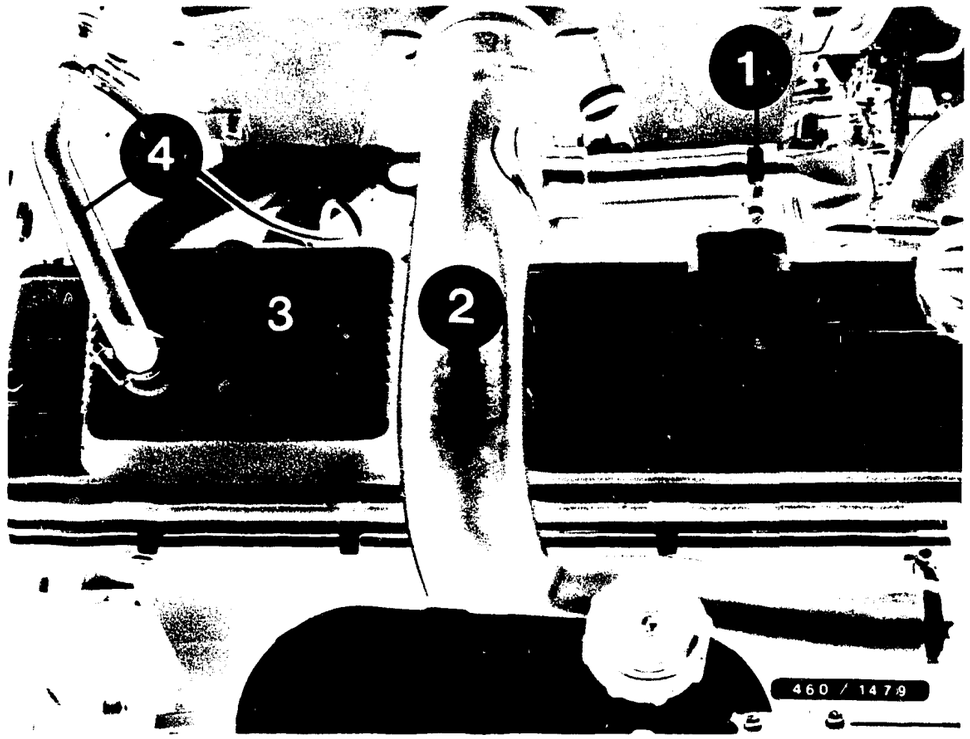
Remove wiring harness (does not apply to 324d).

Using a commercially-available spring clip, pinch off the coolant hose a short distance after the water pump.

Loosen hose clamp and disconnect coolant hose.

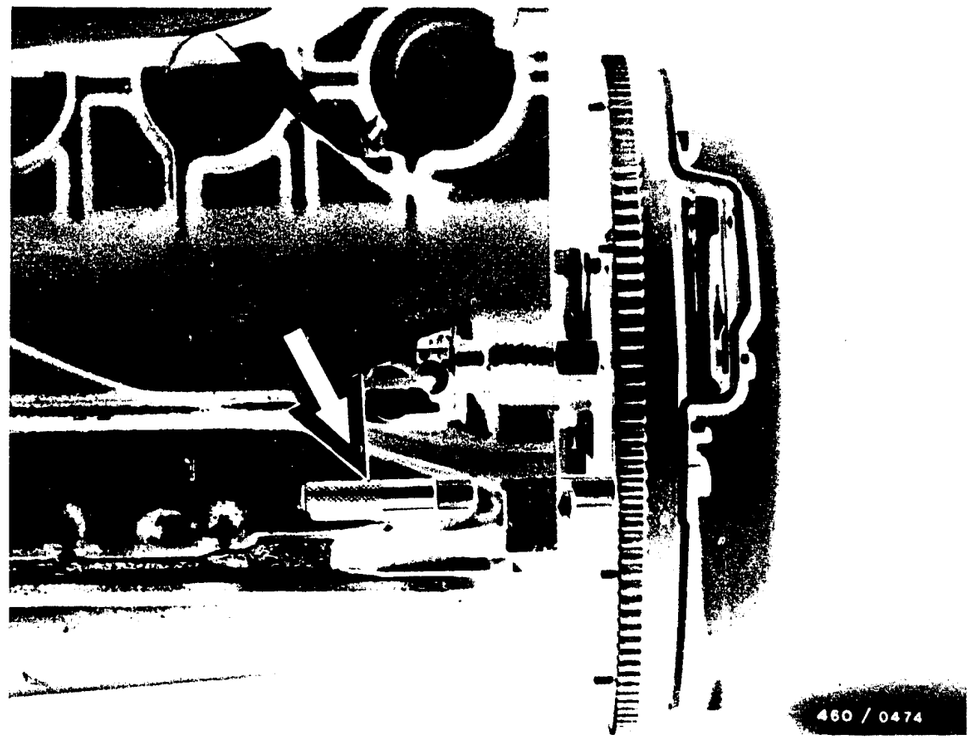
Catch coolant.

Remove toothed-belt cover.

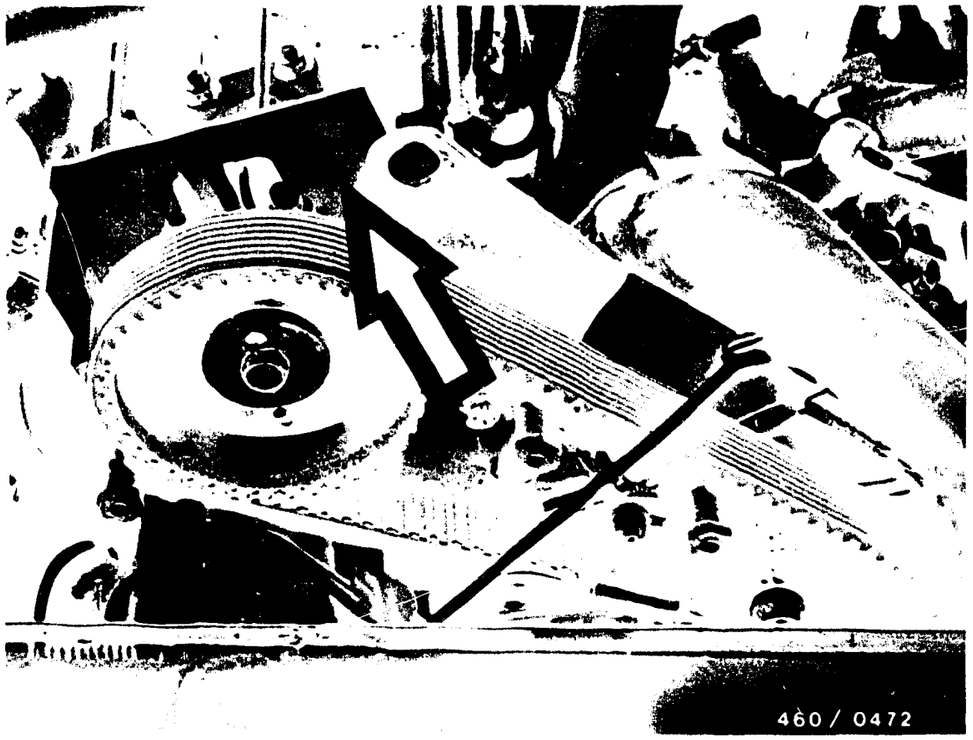


1 = Crankcase ventilation
2 = Connecting hose
3 = Cylinder-head cover
4 = Vacuum hose

Remove crankcase ventilation, connecting hose between turbo-supercharger/air filter and collecting manifold, vacuum hose, and cylinder-head cover.

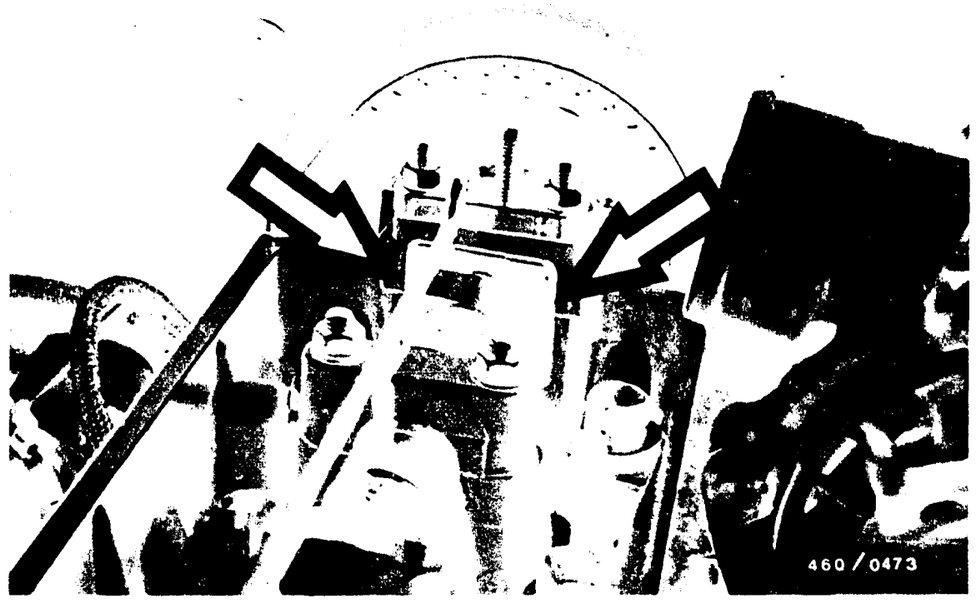


Hold flywheel in position with setting mandrel KDEP 1139 (arrow).



Hold camshaft in position with stop device KDEP 1136 (arrow).

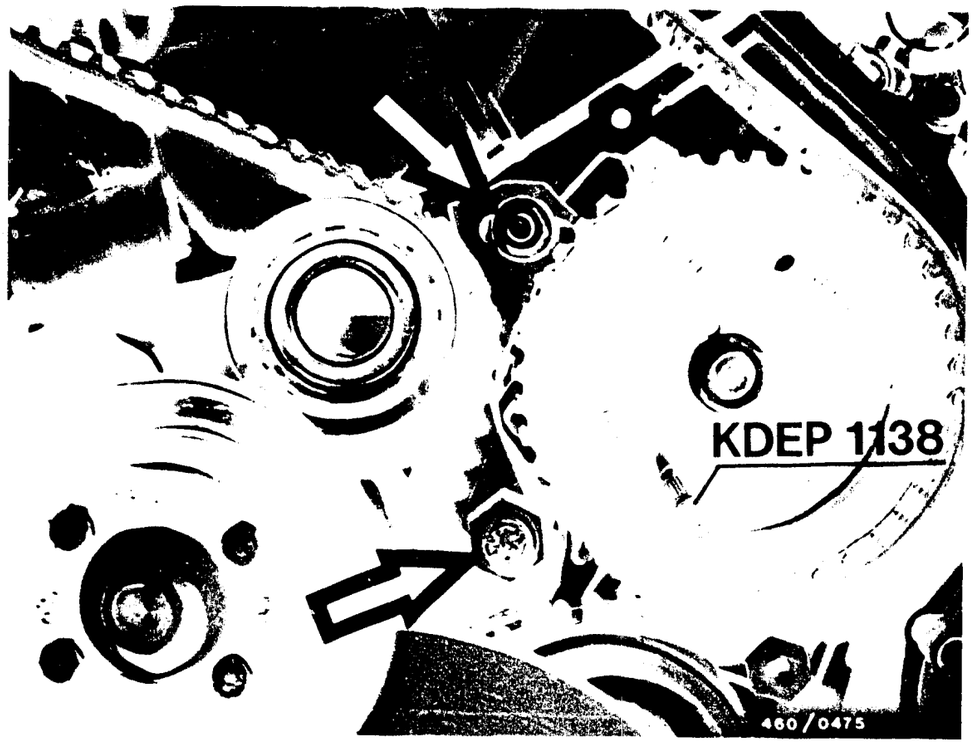
The valves of cylinder 6 are at overlap.



If it is not possible to affix the stop device, correct the engine timing.

Note:

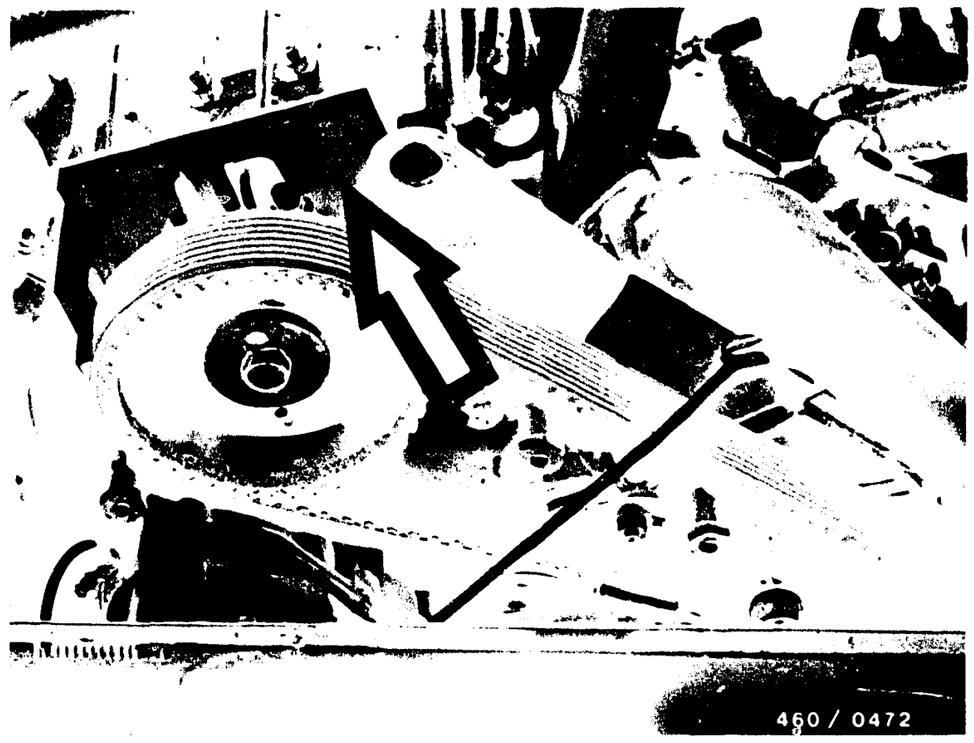
The stop device fits only over the two finished surfaces of the square (arrows).



31.2 Adjusting engine timing

Loosen fastening nut / bolt of the tensioning-pulley mounting (arrows).

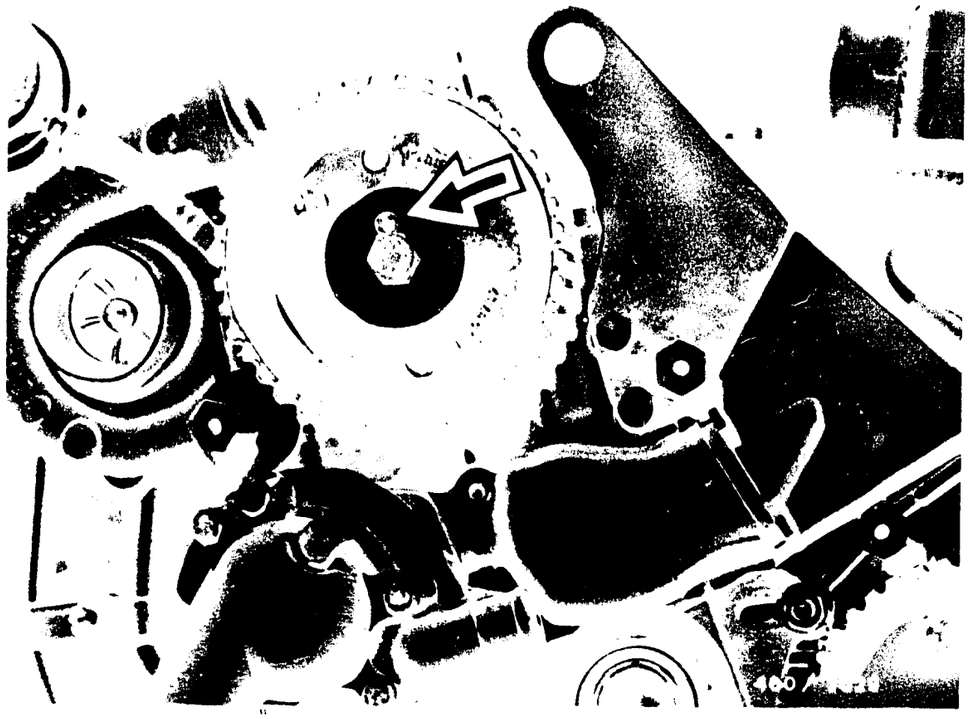
Slacken and remove the toothed belt.



Turn camshaft until stop device can be set over the finished surfaces of the square.

Note:

Do not remove setting mandrel KDEP 1139.



Loosen fastening screw of camshaft timing gear.

Move camshaft timing gear against the pin <u>in direction of travel</u> to stop (arrow).

Tighten fastening screw of camshaft timing gear <u>by hand</u>.

Put on toothed belt.

<u>Note:</u>

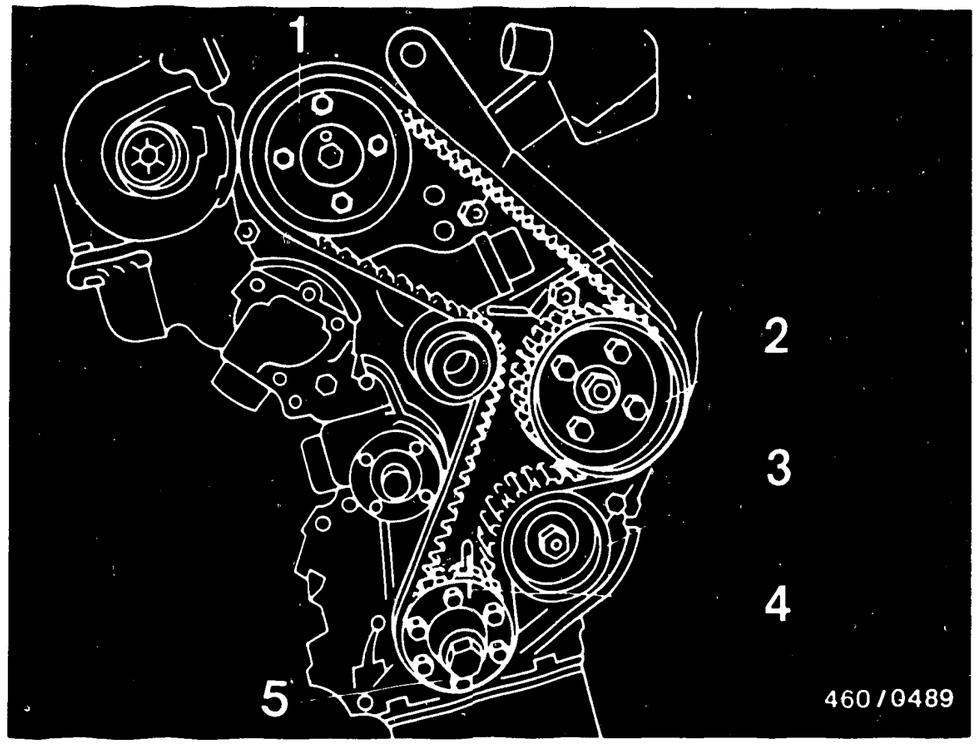
If a used toothed belt is re-used, it may be mounted only in its previous direction of travel.

Porous or worn toothed belts should be replaced.

If the toothed belt is <u>not</u> replaced, continue on Coordinate G18.

It is not necessary to continue here.

Never turn the crank- or camshaft with the toothed belt removed, as otherwise the valves can knock against the pistons.

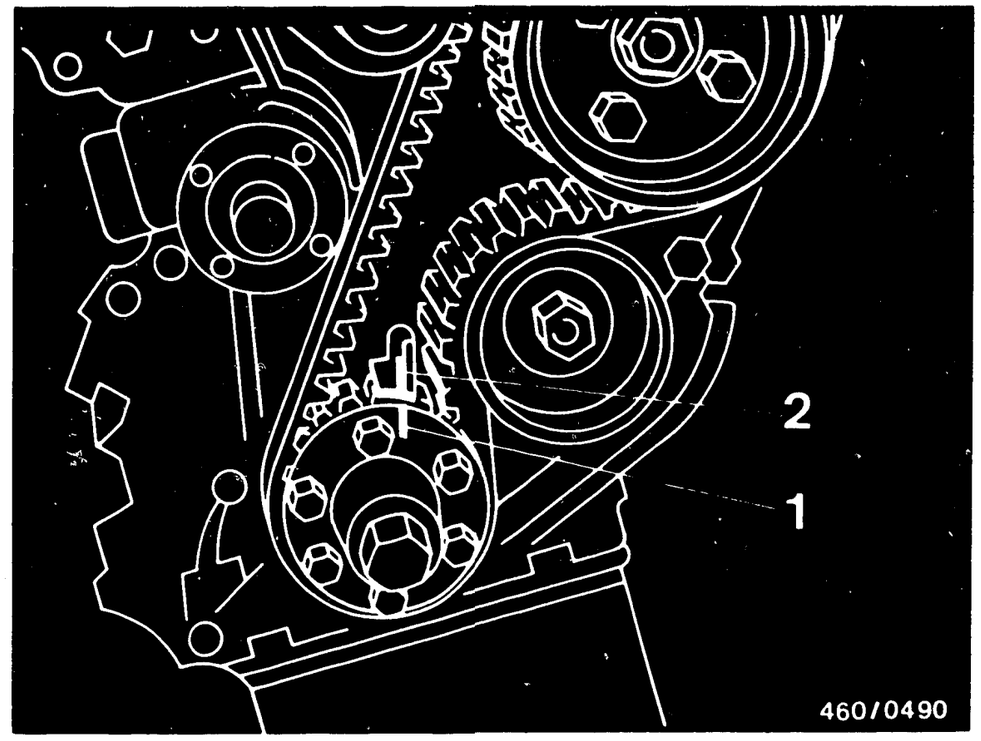


1 = Camshaft timing gear
2 = Injection-pump gear
3 = Toothed-belt pulley for idler shaft
4 = Marking on vibration damper
5 = Vibration-damper hub

* Replacing toothed belt

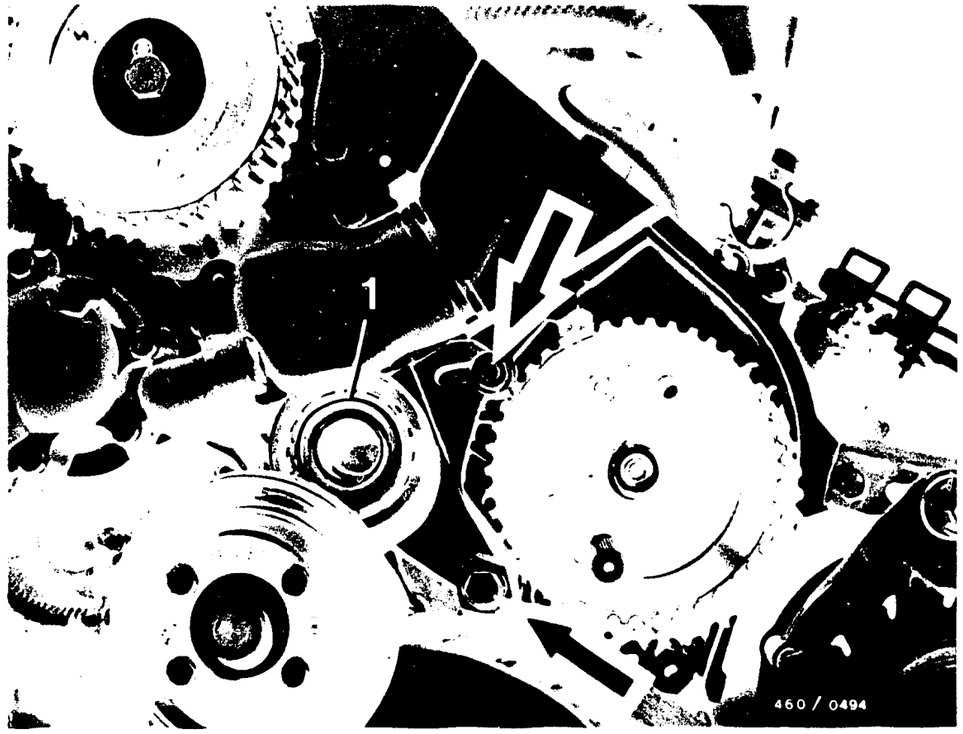
Remove toothed-belt pulley (vibration damper) from the vibration-damper hub of the crankshaft.

Remove toothed belt.



1 = Mark on vibration damper
2 = Reference mark, toothed-belt cover

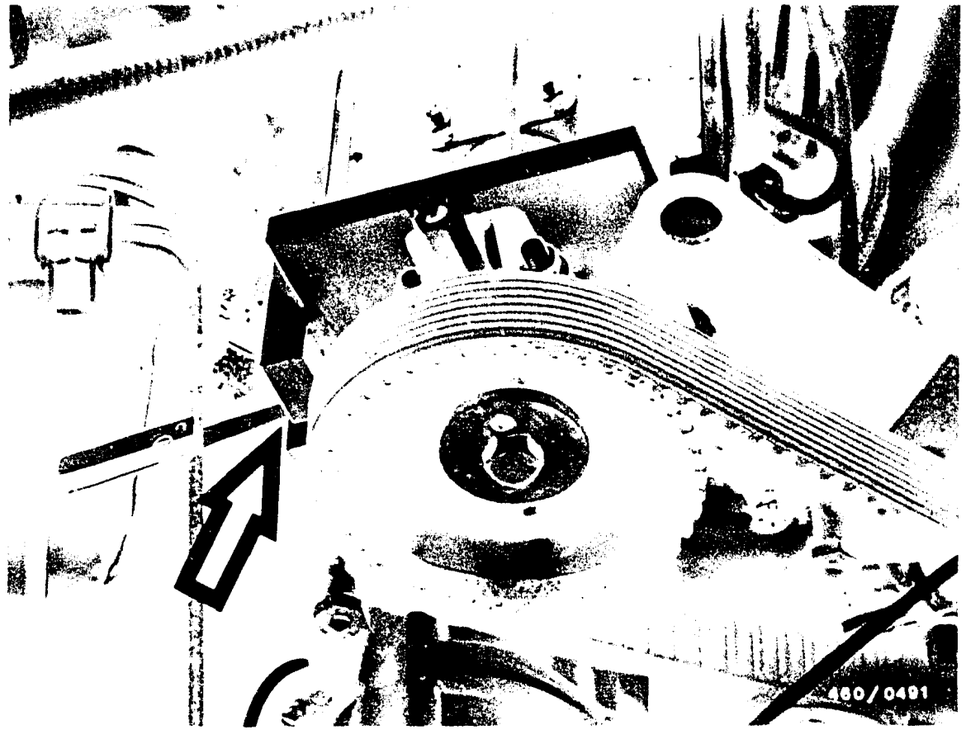
Prior to mounting the toothed belt, check to see if the mark on the crankshaft vibration-damper hub is aligned with the reference mark on the rear toothed-belt cover.



1 = Tensioning roller

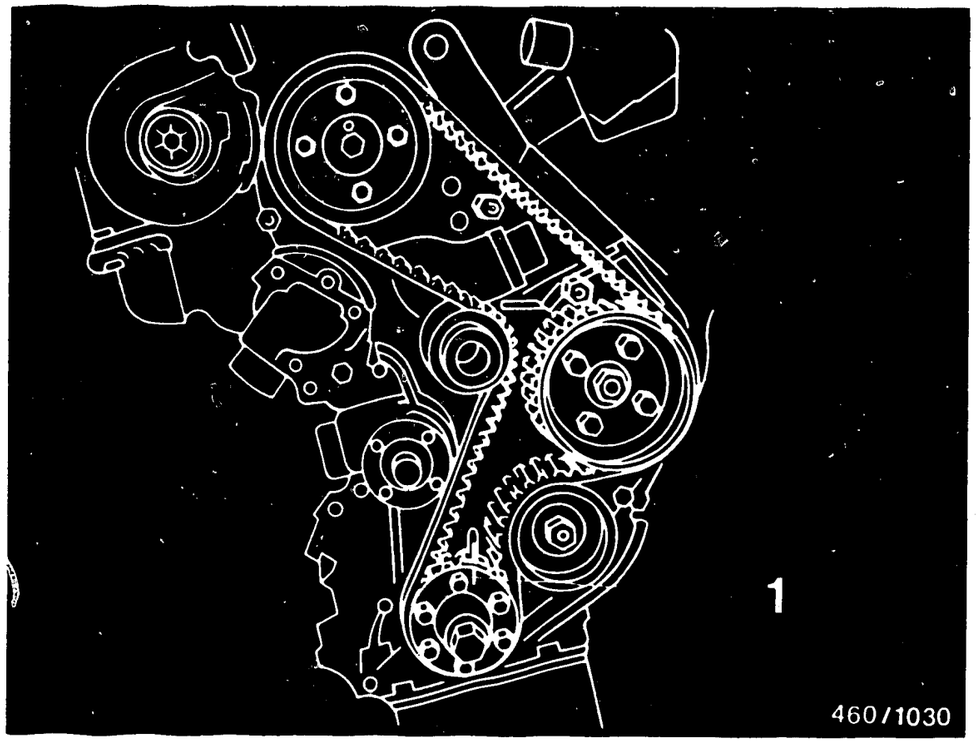
Tighten the fastening nut/bolt of the tensioning-nut bracket by hand (arrows).

Starting with the crankshaft timing gear, mount and engage the toothed belt on the injection-pump gear and (under tension) over the camshaft gear.

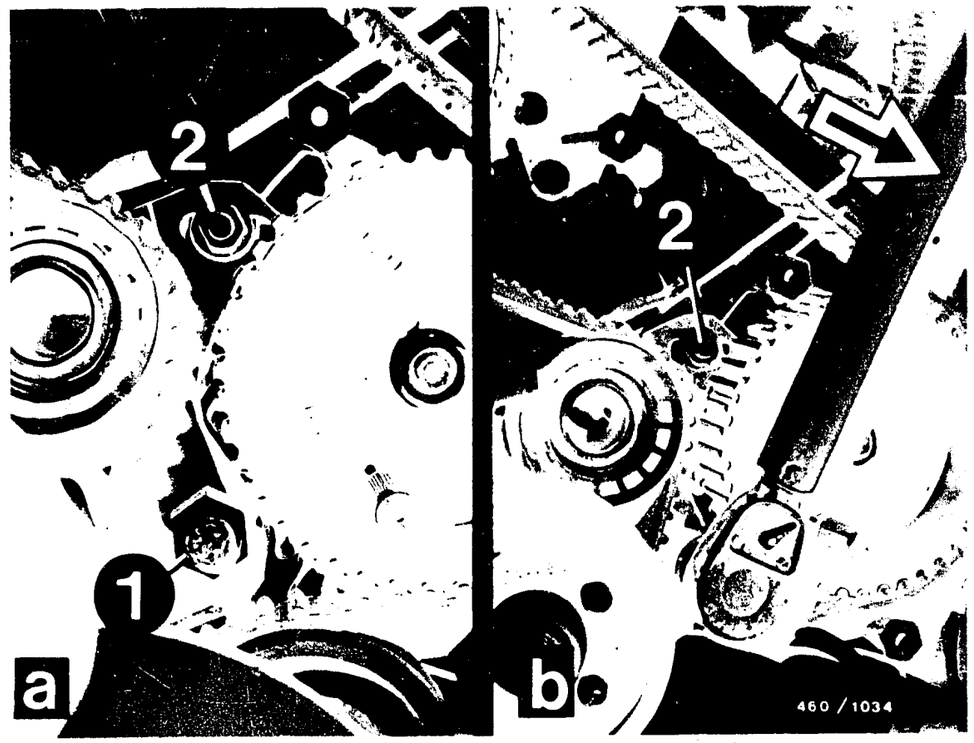


Note:

If the toothed belt is new, a 2.5 mm feeler gauge must be inserted between the sealing surface (cylinder-head hood) and the stop device KDEP 1136 on the outlet side (arrow).



Mount the V-belt pulley on the crankshaft vibration-damper hub (1) and tighten to 22...24 Nm.



1 = Tensioning point
2 = Top fastening nut

Careful:

The toothed belt must engage correctly.

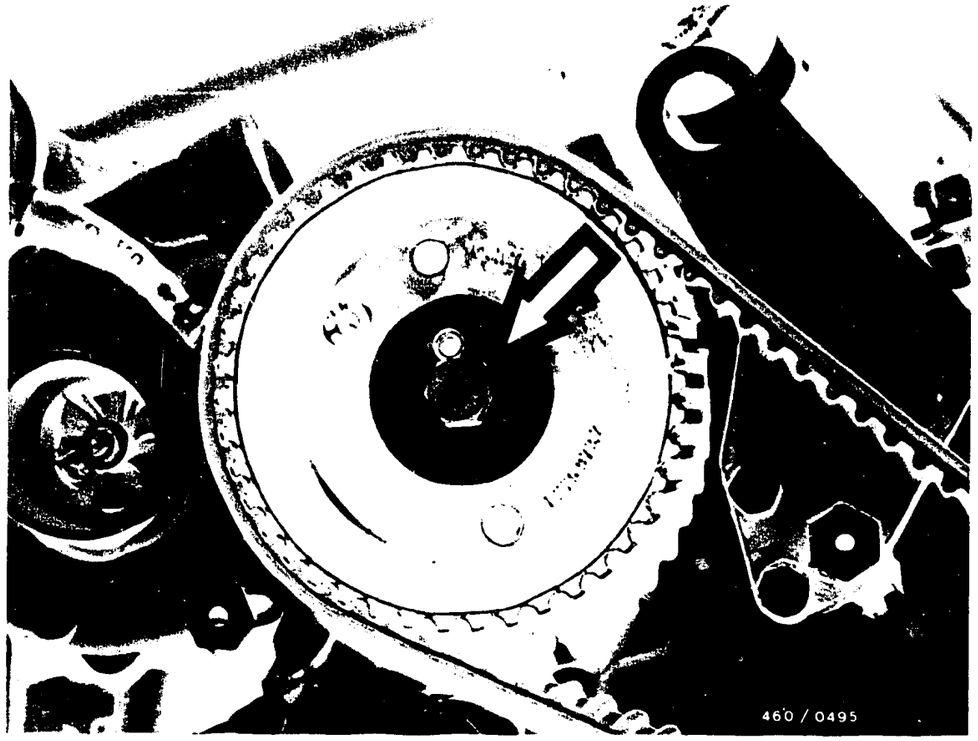
Pivot the tensioning roller at 45...50 Nm at the tensioning
point against the back of the toothed belt (arrow) and tighten the toothed belt.

Tighten top fastening nut (2) to 20...24 Nm.

Note:

Use only a torque wrench with indicator (adjustable wrenches are not suitable).

Remove torque wrench and tighten bottom fastening screw (1) to 20...24 Nm.

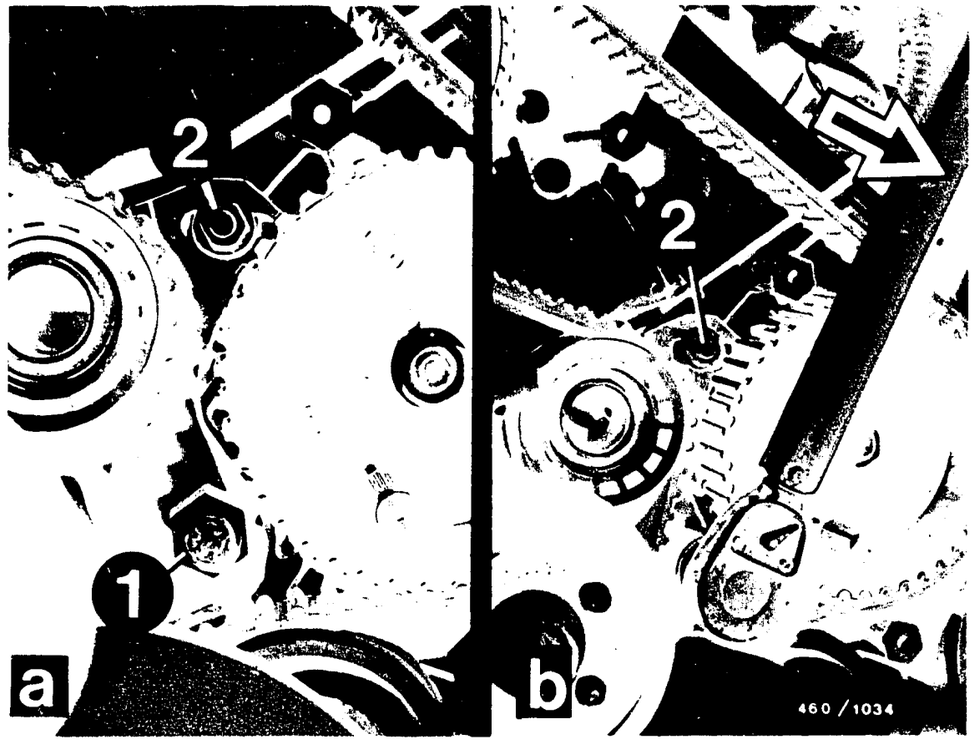


Tighten camshaft gear to prescribed torque of 65...70 Nm (arrow).

Remove stop device KDEP 1136 from camshaft and setting mandrel KDEP 1139 from flywheel.

Mount and tighten generator V-belt.

Section on changing toothed belt is now completed, continue on Coordinate G20.



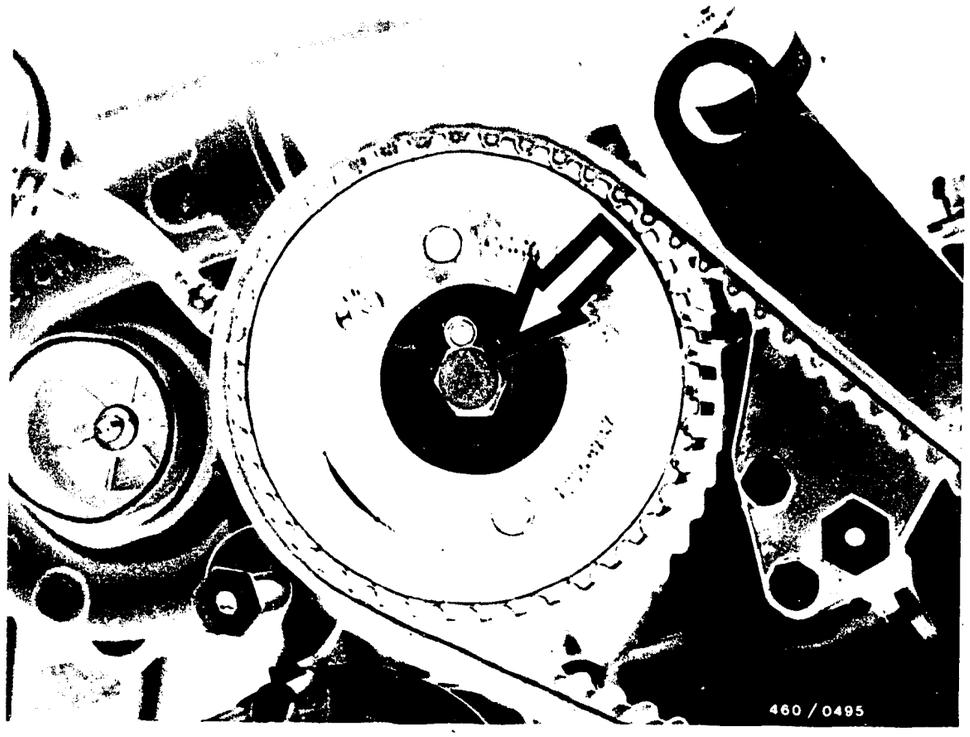
1 = Tensioning point
2 = Top fastening nut

Pivot tensioning roller 45...55 Nm (above 15,000 km / 9,000 miles, 30...35 Nm) at tensioning point against back of
toothed belt (figure b, arrow), and tighten belt.

Tighten top fastening nut (2) to 20...24 Nm.

Use only torque wrench with indicator (adjustable wrenches not suitable).

Remove torque wrench and tighten lower fastening screw (1) to 20...24 Nm.

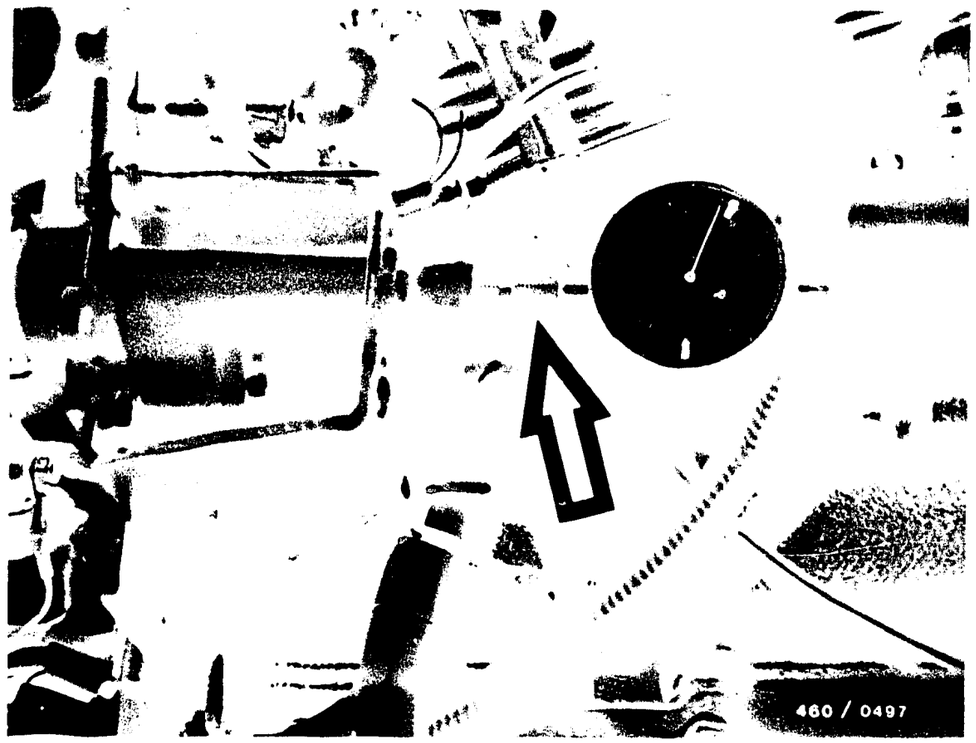


Tighten camshaft timing gear to prescribed torque of 65...70 Nm (arrow).

Remove stop device KDEP 1136 from camshaft and setting mandrel KDEP 1139 from flywheel.

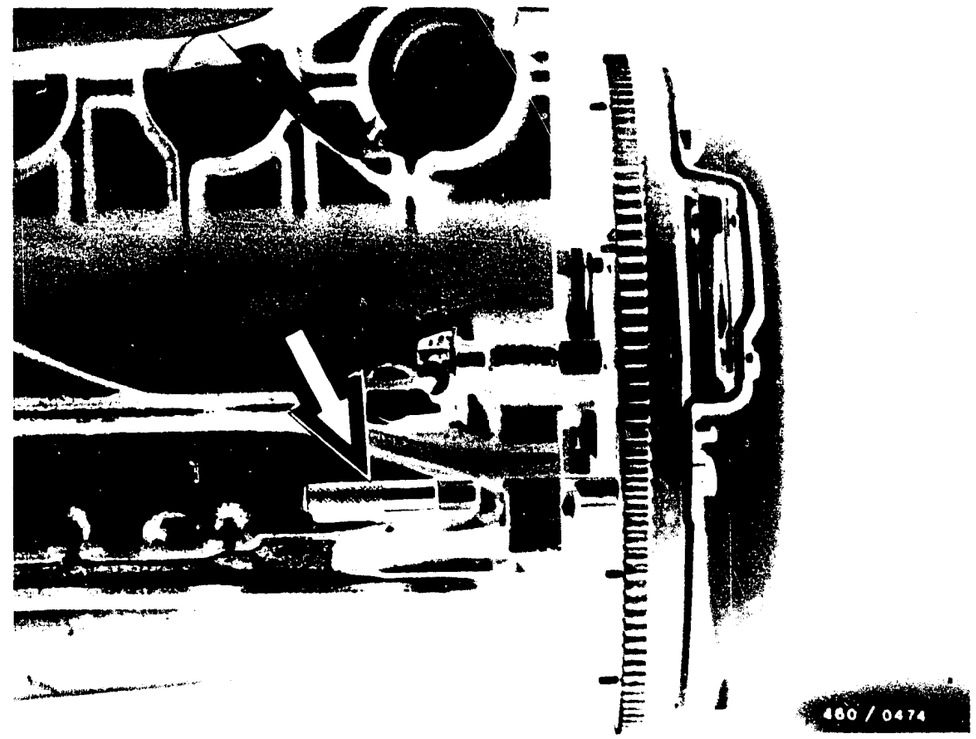
Remove injection tubing at fuel-injection pump and at nozzle holders (counterhold to prevent loosening of the delivery-valve holders).

Unscrew bleeder screw from central screw plug (triangle-head bolt) of the distributor head (arrow).



Screw measuring tool KDEP 1085 (arrow) into the tapped hole of the bleeder screw.

Mount small dial indicator with measuring adapter in measuring tool KDEP 1085.



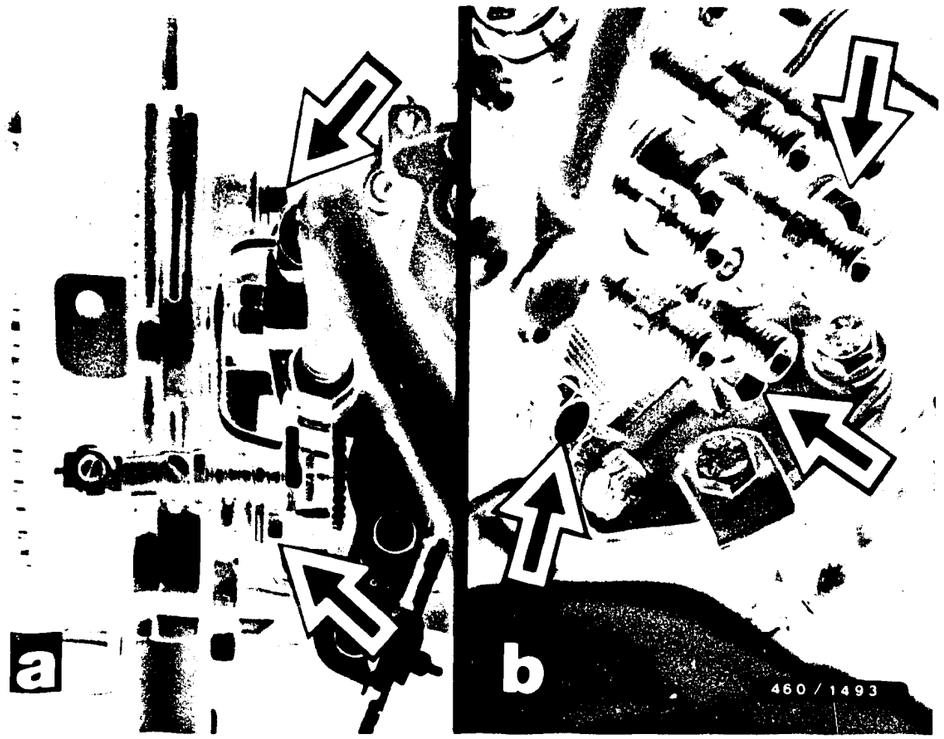
Pre-tension dial indicator about 2.5 mm.

Slowly turn the crankshaft against the direction of engine rotation until the needle of the dial indicator no longer moves.

Set dial indicator to "0".

Turn crankshaft in direction of engine rotation until the 1rst cylinder is at TDC.

Fix location of flywheel with setting mandrel KDEP 1139 (arrow).



In this position, the dial indicator should show a setting value of:

324d	0.74--0.02 mm after BDC
524td	0.74+0.02 mm after BDC.

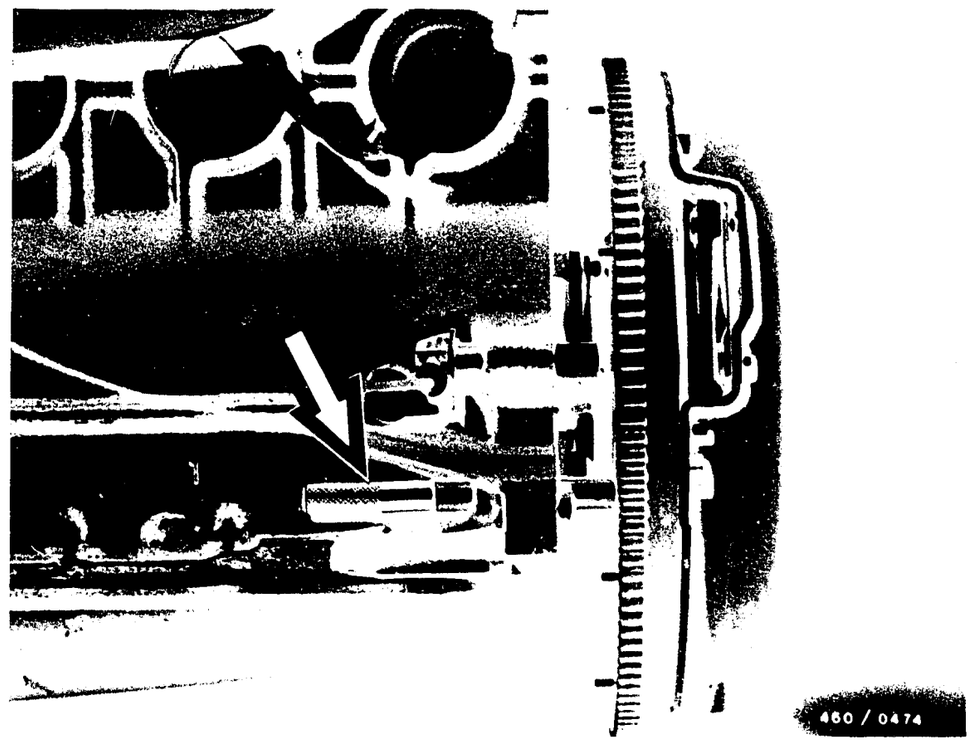
If correction is necessary, loosen the fastening screws of the fuel-injection pump (figure a/b - arrows).

Swivel fuel-injection pump until the appropriate setting value is obtained.

Note:

If the reading obtained is too small, swing the pump towards the engine.

If the reading is too large, swing the pump away from the engine.



Tighten fuel-injection-pump fastening screws to 25 Nm.

Remove setting mandrel KDEP 1139 (arrow).

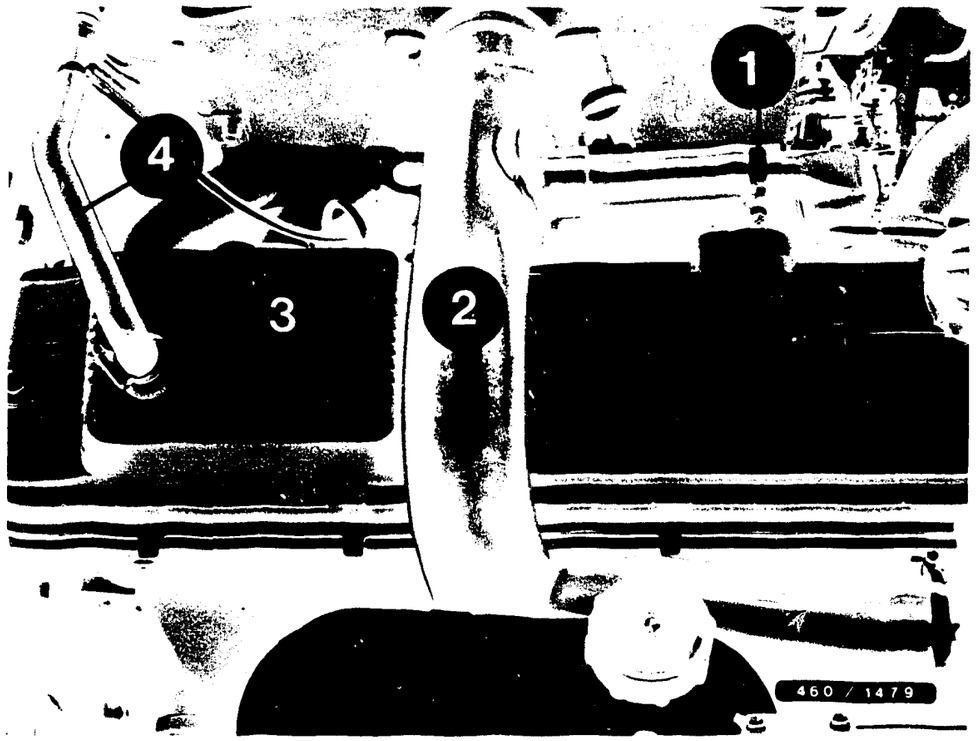
Turn crankshaft two full revolutions and inspect adjustment.

Remove measuring tool KDEP 1085 with dial indicator.

Install bleeder screw using new seal ring.

Bolt on angle support of fuel-injection pump, tightening to 20...24 Nm.

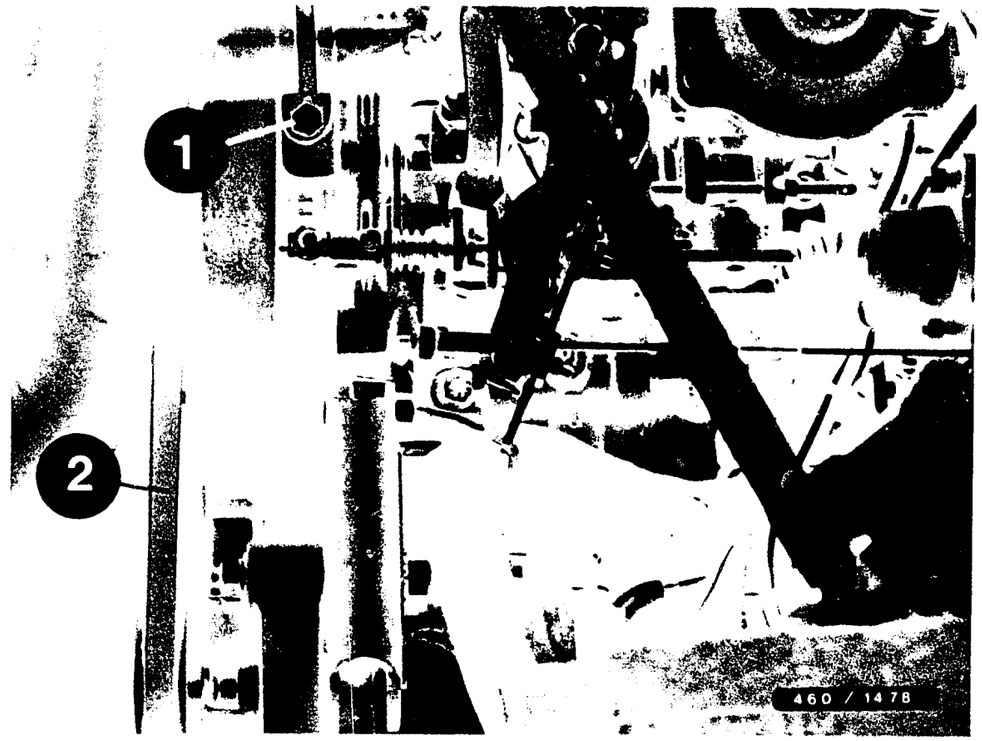
Mount injection tubing using open-ended wrench KDEP 1115 (counterhold to prevent the delivery-valve holders from turning).



1 = Crankcase ventilation
2 = Connection hose
3 = Cylinder-head cover
4 = Vacuum hose

Install crankcase ventilation, connection hose between turbo-supercharger/air filter and collecting manifold, and cylinder-head cover.

Connect vacuum hose to vacuum pump and negative cable to battery.

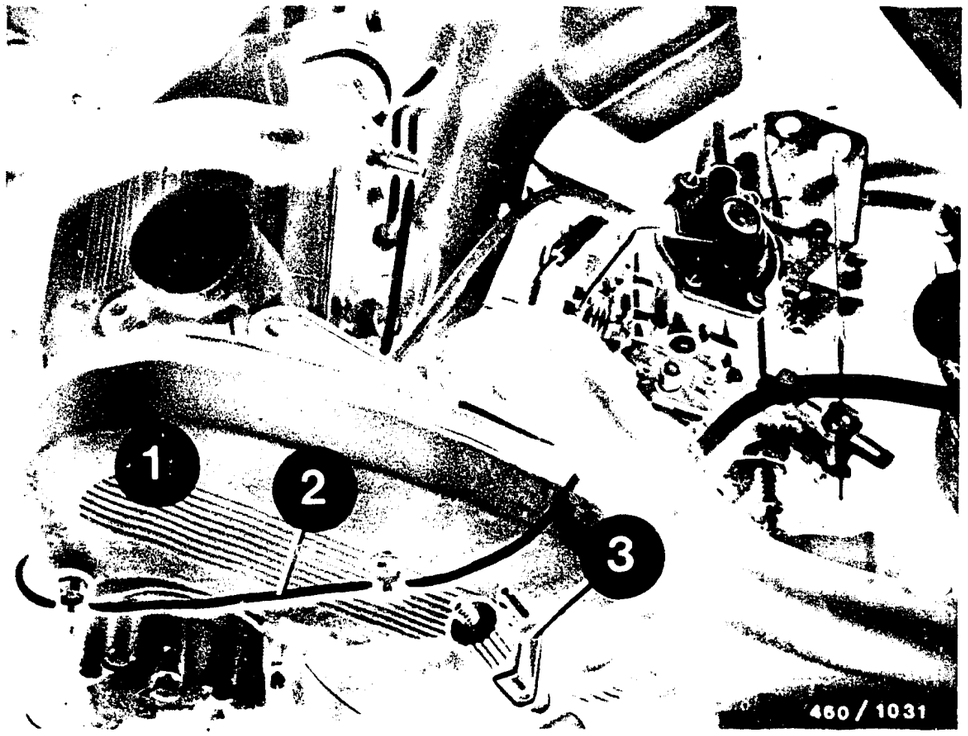


1 = Hose clamp

2 = V-belt

Affix coolant-hose clamp.

Position and tighten generator V-belt.

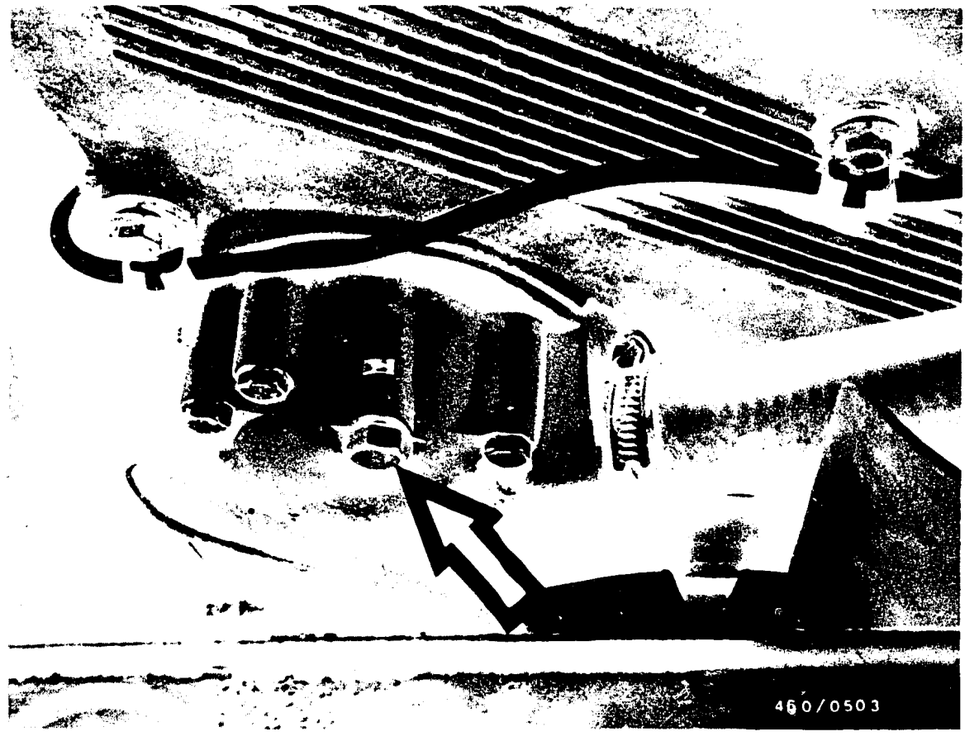


1 = Toothed-belt cover
2 = Wiring harness
3 = Spring clip

Fastening wiring harness (not on 324d).

Connect coolant hose to water pump and remove spring clip.

Tighten hose clamp.



* Bleeding cooling system

Add coolant until it reaches the mark in the expansion tank.

Seal expansion tank.

Fully open heater controls.

Let engine run until it reaches normal operating temperature.

Loosen bleeder screw (arrow) at water pump until coolant escapes.

Tighten bleeder screw.

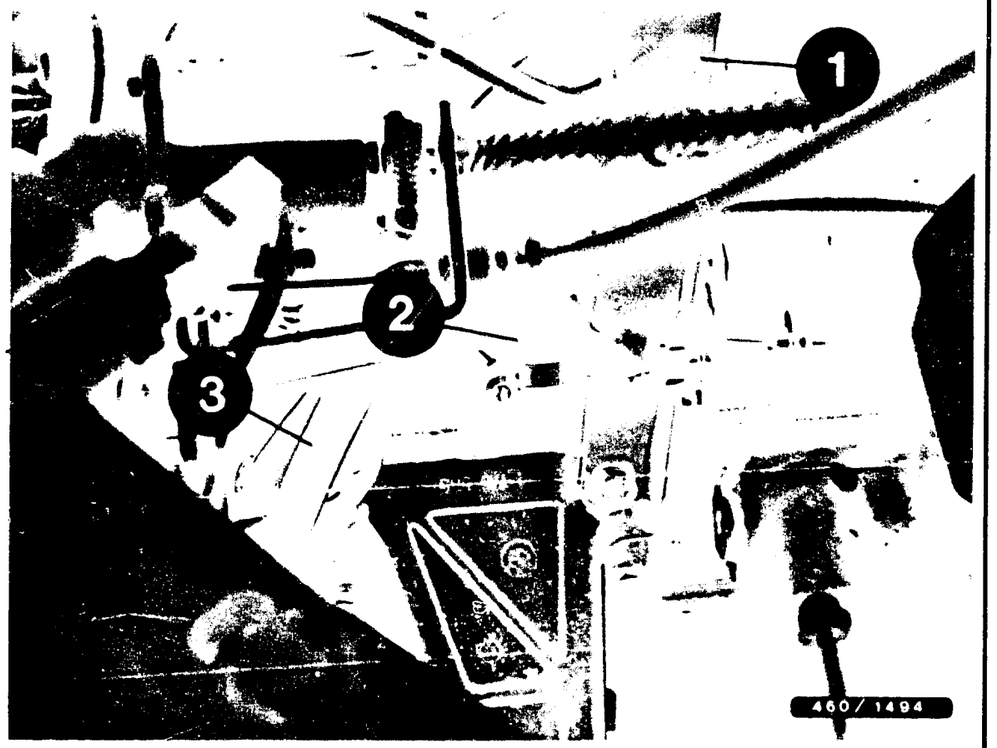
Affix engine-compartment guard to bottom of engine (324d).

32. COORDINATING FUEL-INJECTION PUMP WITH ENGINE

Disconnect negative lead from battery.

Turn crankshaft until TDC mark (cylinder 1) on belt pulley (vibration damper) is aligned with the reference mark (arrow).

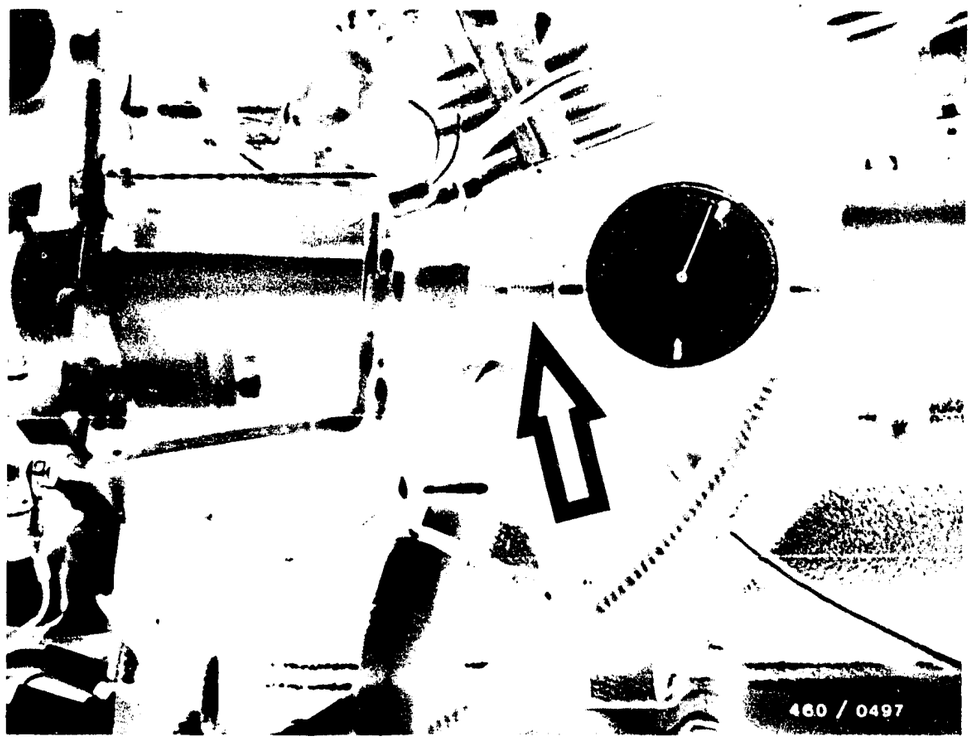
The piston of the 1rst cylinder is at TDC (valves of cylinder 6 are at overlap).



1 = Angle bracket for collecting manifold
2 = Crankcase ventilation hose
3 = Dipstick guide tube

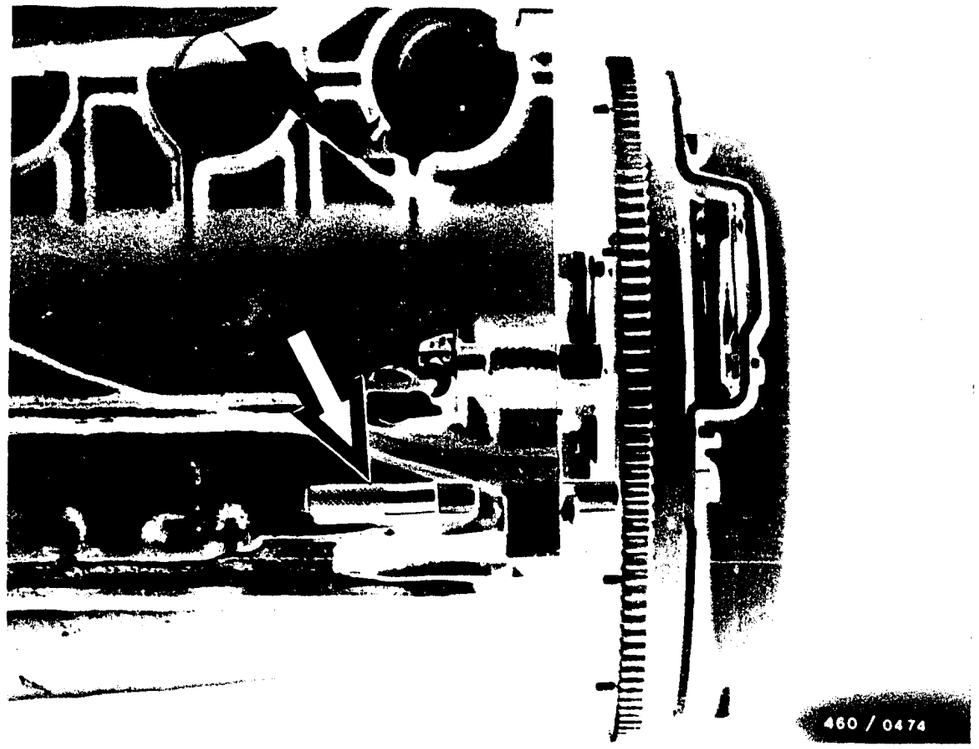
Remove angle bracket, ventilation hose, and guide tube.

Unscrew bleeder screw from central screw plug (triangle-head bolt) of distributor head (arrow).



Insert measuring tool KDEP 1085 (arrow) into the tapped hole of the bleeder screw.

Mount small dial indicator with measuring adapter in measuring tool KDEP 1085.



Pre-tension dial indicator about 2.5 mm.

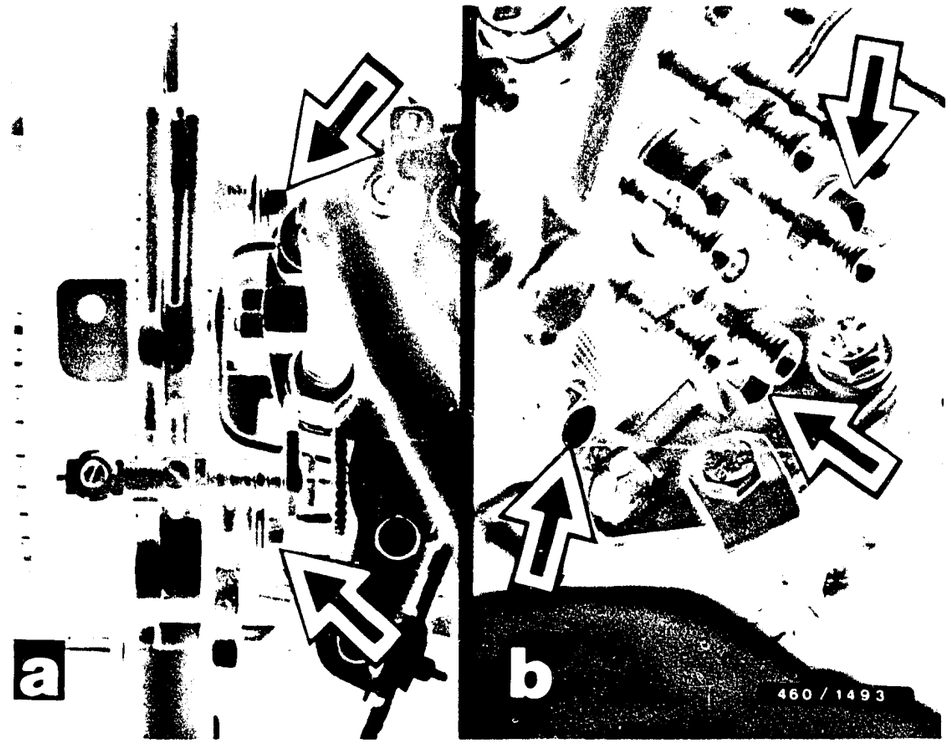
Remove setting mandrel KDEP 1139.

Slowly turn the crankshaft against the direction of engine rotation until the needle of the dial indicator no longer moves.

Set dial indicator to "0".

Turn crankshaft in direction of engine rotation until the 1rst cylinder is at TDC.

Arrest flywheel with setting mandrel KDEP 1139 (arrow).



In this position, the dial indicator should show an inspection value of:

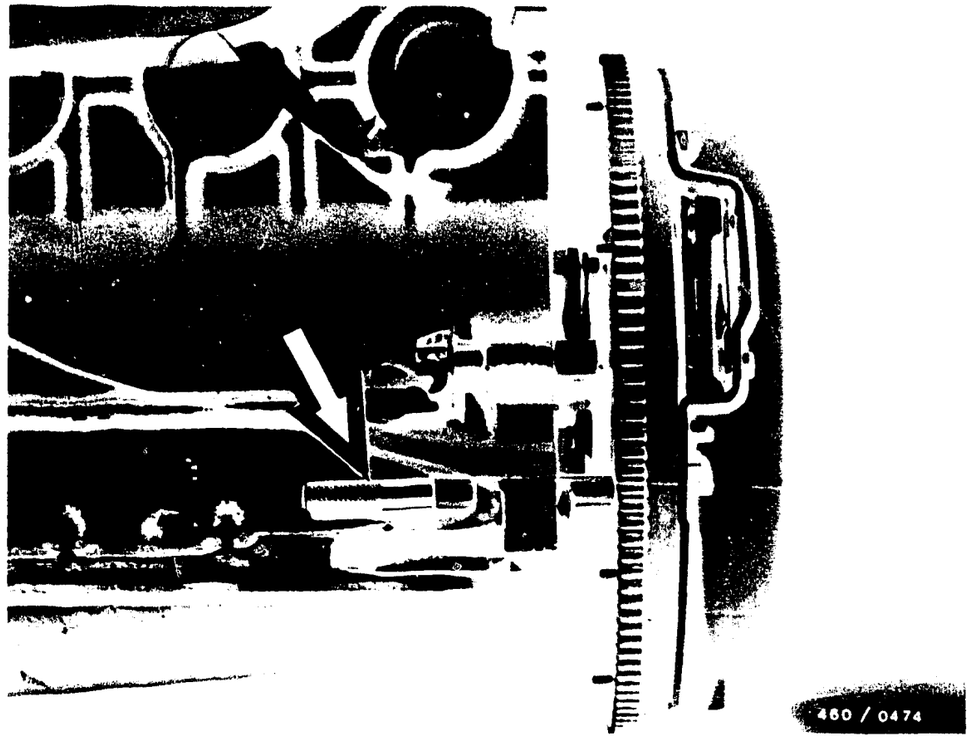
324d	0.70...0.74 mm after BDC
524td	0.72...0.76 mm after BDC.

If correction is necessary, loosen the fastening screws of the fuel-injection pump (figures a and b - arrows).

Set fuel-injection pump to the appropriate setting value by pivoting.

324d	0.74-0.02 mm after BDC
524td	0.74+0.02 mm after BDC

Note:
If value is too small, move pump towards engine.
If value is too large, move pump away from engine.



Tighten fastening screws to 25 Nm.

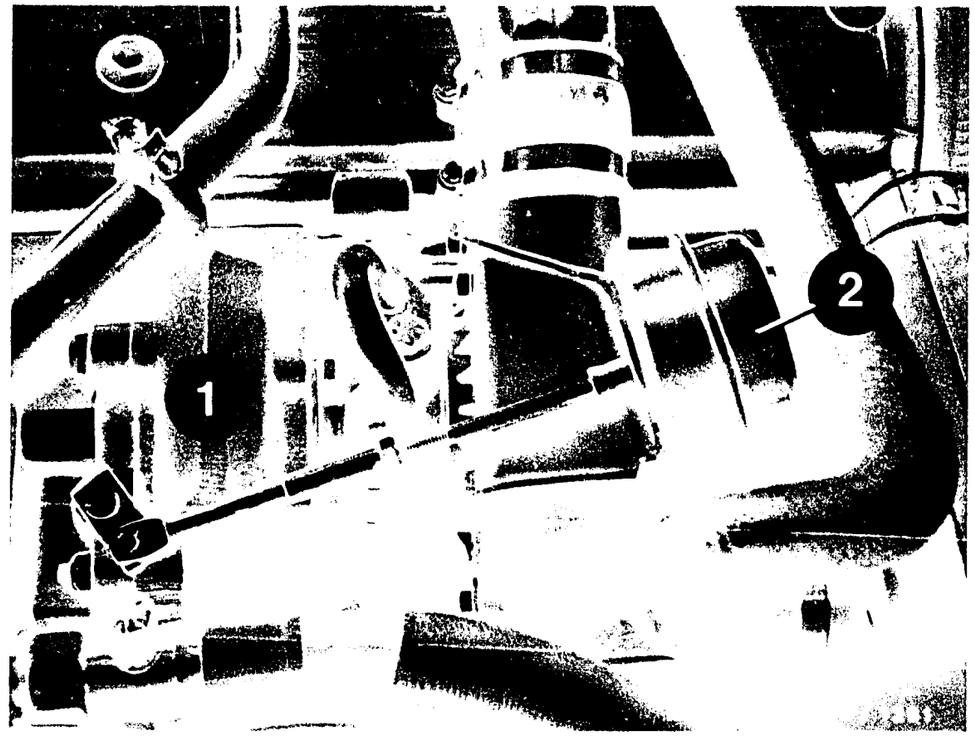
Remove setting mandrel KDEP 1139 (arrow).

Turn crankshaft two full revolutions and check setting.

Removing measuring tool KDEP 1085 with dial indicator.

Install bleeder screw using new seal ring.

Remount angle bracket, ventilation hose, and guide pipe.



1 = Exhaust turbo-supercharger
2 = Charge-air-pressure control valve

33. TESTING CHARGE-AIR PRESSURE

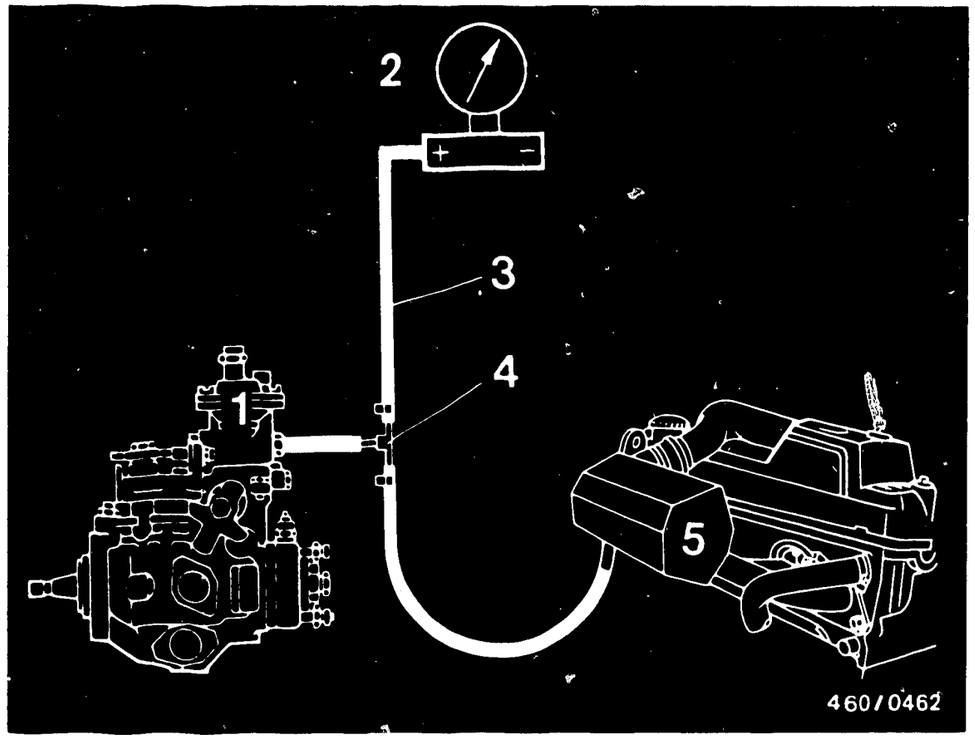
When working on the tubo-supercharger, be aware that even the smallest particles of dirt can lead to the destruction of the supercharger.

For this reason the engine should never be operated without an air filter.

I m p o r t a n t !

The connection hose to the charge-air-pressure control valve must not be disconnected.

A disconnected connecting hose can lead to excessive loading and irreparable damage to the engine at full power.



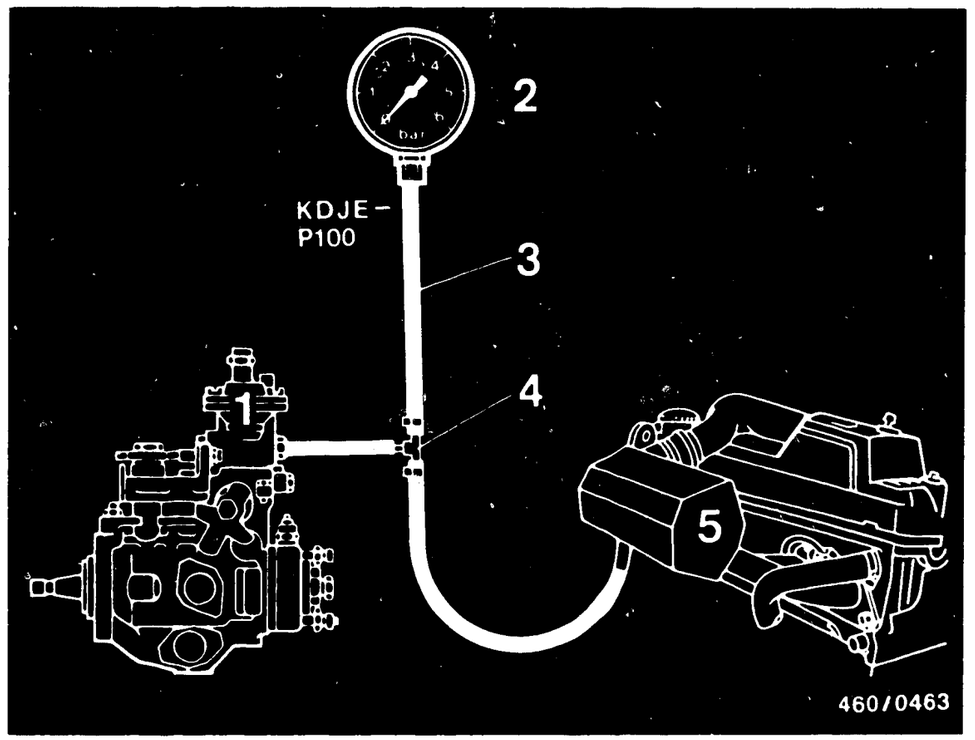
1 = LDA
2 = Differential-pressure gauge
3 = Connecting hose
4 = T-piece
5 = Charge-air pipe

The differential-pressure gauge or pressure-measuring device KDJE-P 100 with the appropriate set of connecting parts (commercially available) can be used for testing the charge-air pressure.

Mounting the differential-pressure gauge

Disconnect the connecting hose between the charge-air tube and the fuel-injection pump (LDA-housing) on one side.

Insert connecting hose with T-piece and connect with differential-pressure gauge (+ side).
Engine must be at normal operating temperature for purposes of testing.

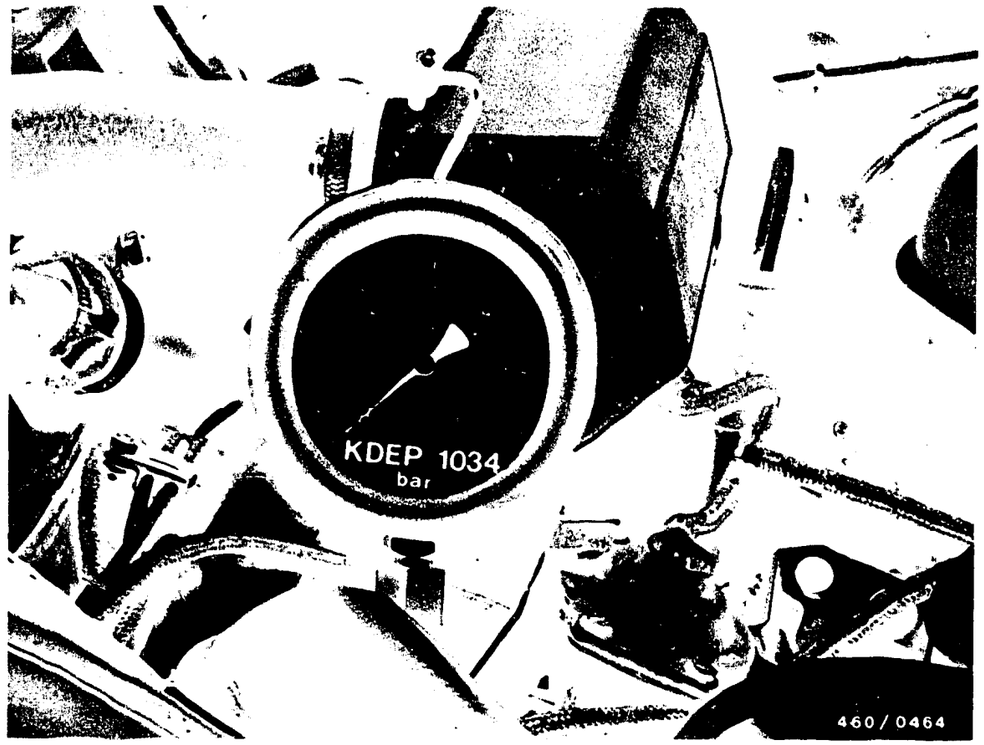


1 = LDA
2 = Pressure-measuring device
3 = Connecting hose
4 = T-piece
5 = Charge-air pipe

Installing the pressure-measuring device (KDJE-P 100)

Disconnect the connecting hose between the charge-air pipe and the fuel-injection pump (LDA-housing) on one side.

Insert connecting hose with T-piece and connect with pressure-measuring device.



Measuring charge-air pressure

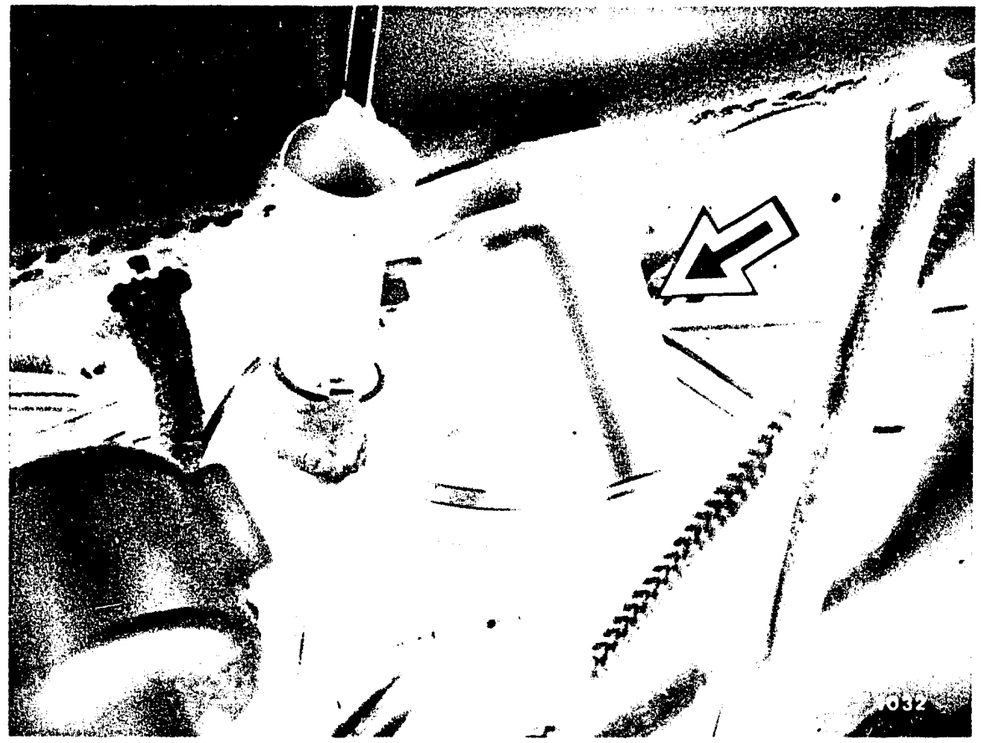
Charge-air pressure is measured under full load, preferably on a chassis dynamometer or on the street, at an engine speed above 2500 min^{-1}.

Read off charge-air pressure at pressure gauge.

Nominal value: 0,77...0,83 bar

Note:

Evaluation of the exhaust turbo-supercharger presupposes that start of delivery and nozzle-opening pressure are correctly set, that there is no leakage on either the air-intake or the exhaust side, and that the engine is in good mechanical condition (valve clearance, compression).



Checking charge-air-pressure relief valve

A charge-air-pressure relief valve (arrow) is located on the charge-air pipe.

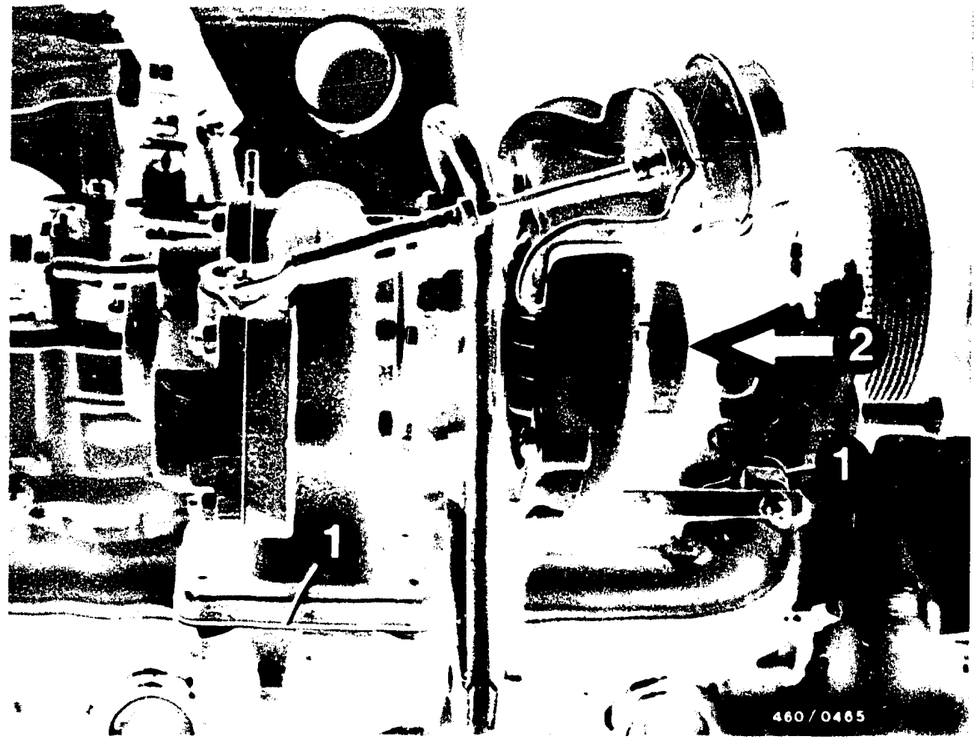
It opens when the charge-air pressure exceeds 0,90...1,10 bar.

During the relief process, a contact in the valve closes and turns on the oil-pressure warning lamp.

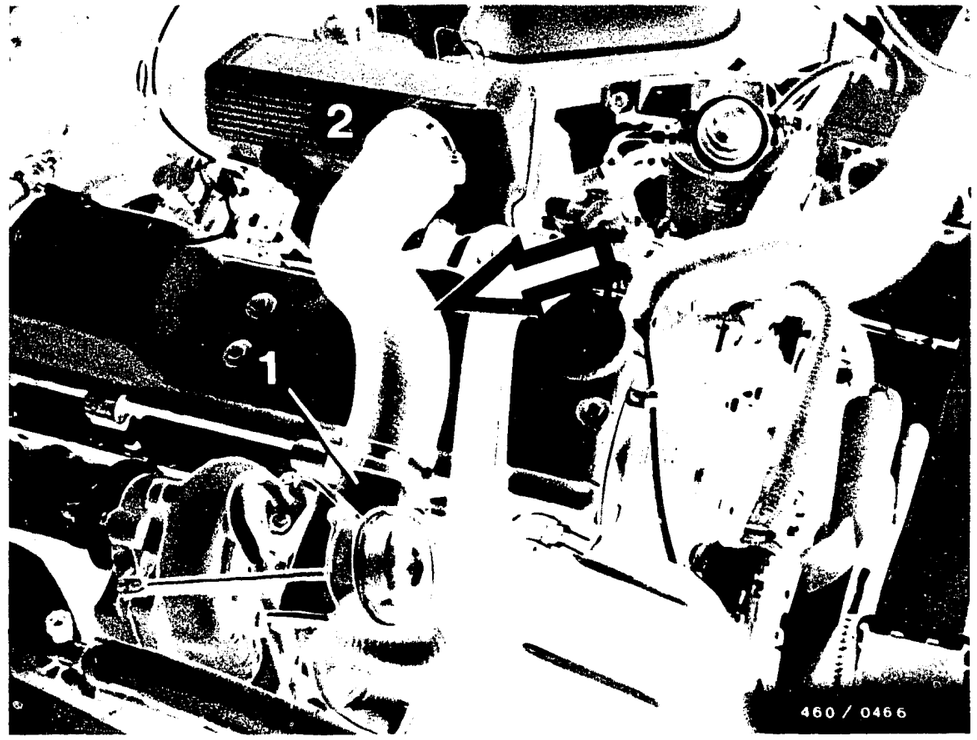
Note:

The oil-pressure warning lamp has two functions:

1. Gives warning in case of insufficient oil pressure.
2. Indicates charge-air pressure if pressure is excessive.



1 = Exhaust-manifold flange sealing
2 = Turbine inlet



1 = Compressor outlet 2 = Charge-air pipe

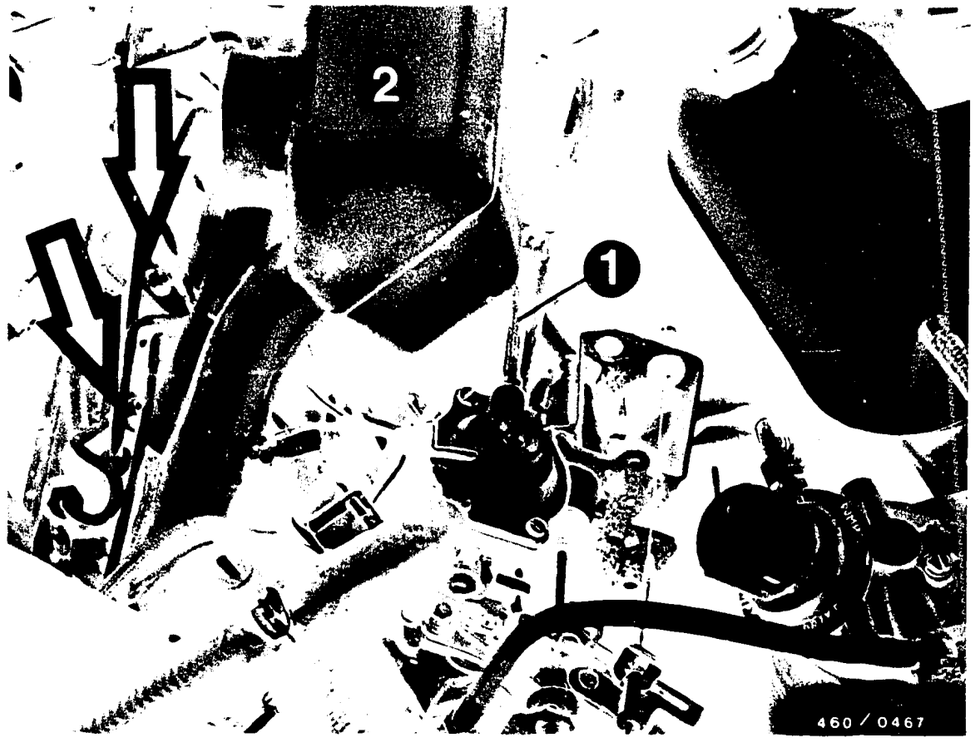
* Connecting hose between compressor outlet and charge-air pipe (arrow).

Checking turbo-supercharger for leakage

In case of insufficient charge-air pressure, inspect the following points for leakage.

* Exhaust-manifold flange sealing

* Turbine-inlet hose clamp.



* Connecting hose (1) between charge-air pipe and fuel-injection pump (LDA-housing).

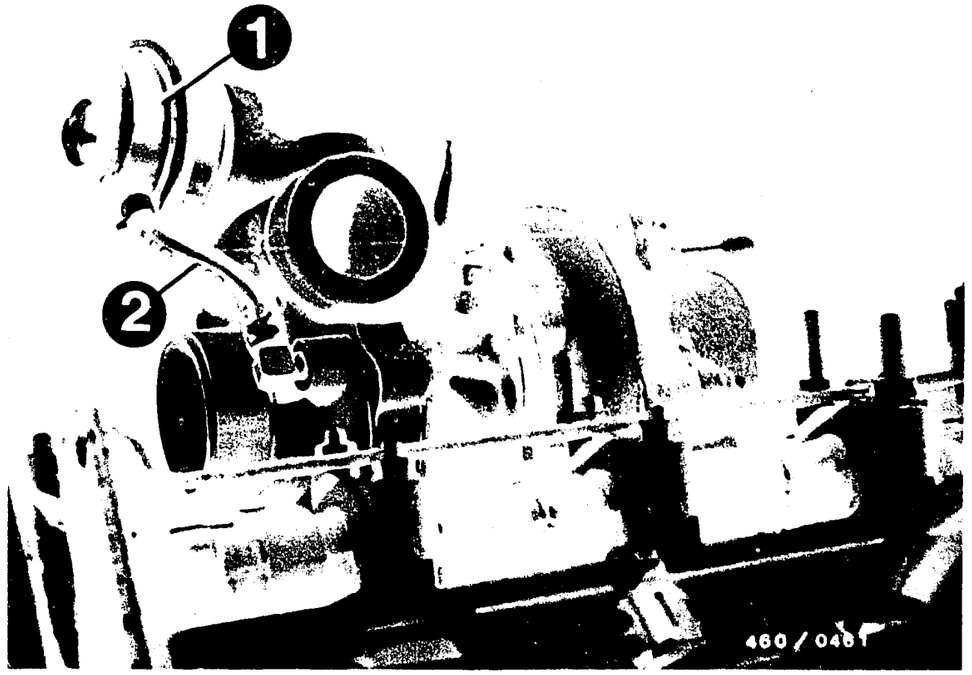
* Sealing between charge-air pipe (2) and engine block (arrows).

Other causes for insufficient charge-air pressure:

* Air filter (dirty).
* Charge-air-pressure regulator incorrectly set.
* Turbine shaft tending to seize = replace exhaust turbo-supercharger.
* Exhaust system blocked.

Note:

After installing a new exhaust tubo-supercharger, fill supercharger with oil and let engine idle for approx. 1 minute, to make certain that the supercharger has an adequate oil supply.

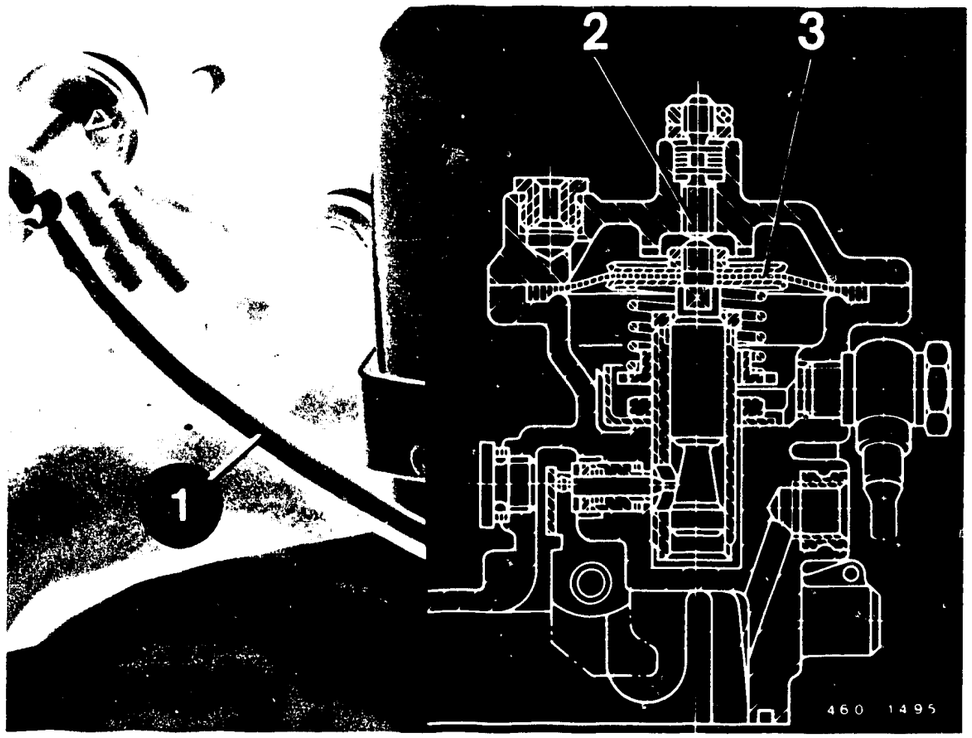


1 = Charge-air-pressure control valve
2 = Connecting hose

Possible causes for excessive charge-air pressure (above 1.0 bar):

* Check connecting hose (2) from compressor housing to charge-air-pressure valve. Replace if connecting hose shows leakage or is kinked.
* Charge-air-pressure control-valve diaphragm defective = replace charge-air-pressure control valve.
* Exhaust valve defective. Check electrical connection for open circuits.
* Value of charge-air-pressure regulator seized or blocked.
  -> Replace charge-air-pressure control valve.
* Valve of charge-air-pressure regulator incorrectly set.

Note: Prior to replacing the charge-air-pressure control valve, check the axial and radial play of the exhaust turbo-supercharger against manufacturer's specifications.



1 = Vacuum hose
2 = Threaded pin
3 = Diaphragm

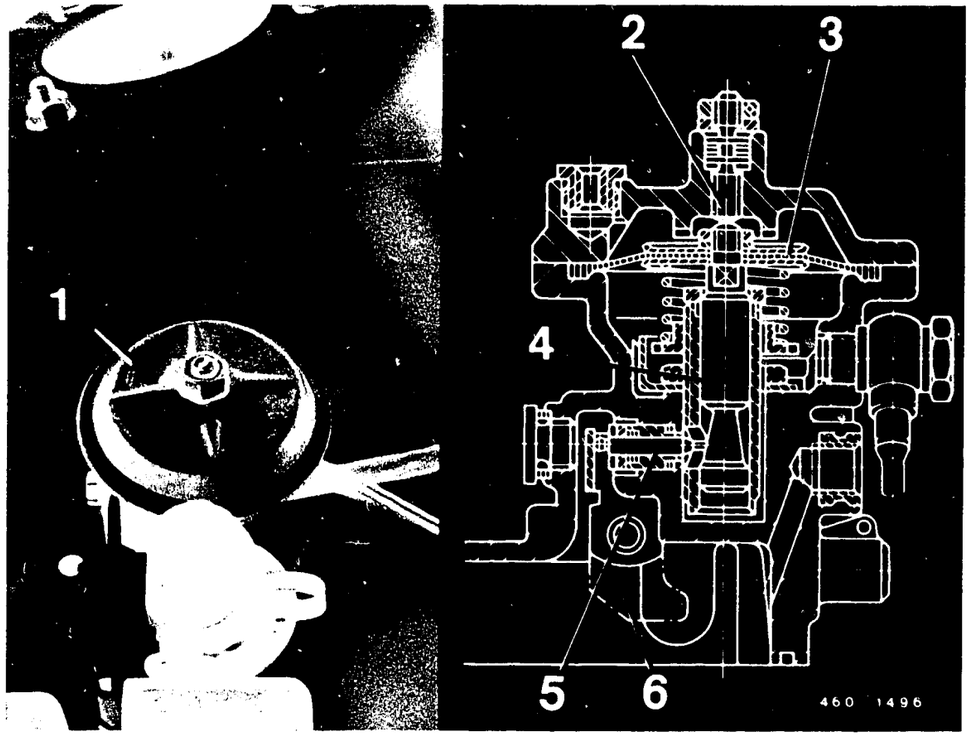
34. TESTING ALTITUDE COMPENSATOR (ADA)

34.1 Leak test of diaphragm in ADA

Connect hand vacuum pump ("Mityvac") at vacuum hose and apply 300...350 mbar.

Disconnect vacuum hose. Diaphragm in ADA should strike audibly against the threaded pin.

If this is not the case, remove fuel-injection pump and repair.



1 = Reference pressure regulator
2 = Threaded pin
3 = Diaphragm
4 = Adjusting pin
5 = Guide pin
6 = Stop lever

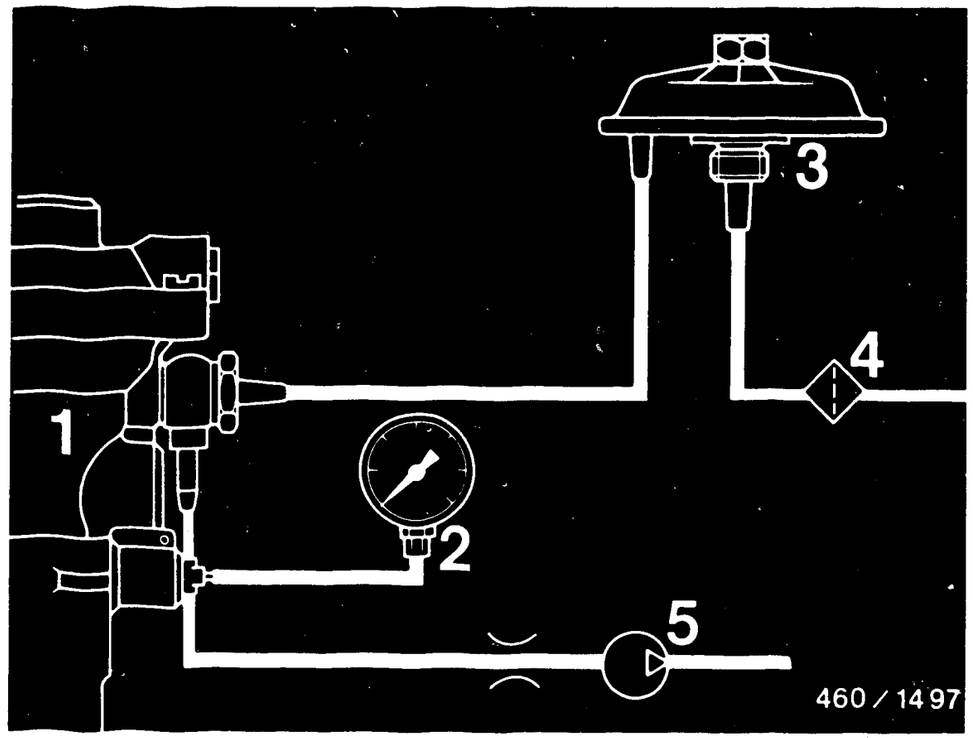
34.2 Testing reference pressure regulator

Operation information:

The reference pressure regulator maintains the pressure below the diaphragm at a constant value.

As air pressure decreases, this causes the diaphragm to move upwards against the threaded pin.

The spring-loaded adjusting pin follows this movement, causing the guide pin to change the position of the stop lever, thus limiting full-load delivery.



1 = ADA
2 = Vacuum-pressure gauge
3 = Reference pressure regulator
4 = Filter
5 = Vacuum pump (engine)

34.2.1 Mounting the vacuum-pressure gauge

Connect pressure gauge between ADA and vacuum pump (engine).

Connect using commercially-available hose and T-piece.

Operate engine at idle speed.

Subtract indicated vacuum from current local atmospheric pressure. This gives the constant pressure below the diaphragm.

Constant pressure

Nominal value: 690...720 bar

Example:

Current local air pressure	970 mbar
Vacuum pressure indicated by pressure gauge	– 260 mbar
Constant pressure below diaphragm.....	710 mbar (absolute)

Note:

If this constant pressure is not reached, it will be evident from the black smoke in the exhaust.

Remedial measures:

Check hose lines for leakage and filter for blockage; if necessary, replace the reference pressure regulator.

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IMPRESSUM

Automotive Equipment - After-Sales Service
Department for Technical Publications KH/VDT
Postfach 50, D-7000 Stuttgart 1.
Published by: After-Sales Service
Department for Training and Technology
(KH/VSK). Press date: 2.1986.